THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE RADIO-TELEGRAPHIC CONVENTION.

IT is appropriate that London should be the venue of the International Radio-telegraphic Conference for the first time that the gathering takes place outside Berlin. The only right which the latter city could claim for this important gathering was that its inception was due to the German Government. The history of the Convention is now sufficiently known to need no recapitulation, but in order to obtain some idea of the significance of the meetings now being held in London, it is essential to bear in mind some of the salient features in connection therewith. For some reason or other, the meetings are being held behind closed doors. No official statement has been made as to the points which are likely to be discussed, and we suppose that the public will only gain access to the proceedings long after interest in them has waned. While there is something to be said for the meetings being held in secret, there is still more reason for making known without any undue delay the opinions of the assembly on the subject of the compulsory installation of wireless telegraphy on ships, and the means for rendering the service more efficient in preventing disasters, and aiding in the work of rescue. Although the question of compulsory equipment does not figure on the agenda published some months ago, there is no doubt that the question will loom very largely before the delegates, and in view of the facts that some important maritime powers have already insisted upon compulsory equipment, and that the matter is under the consideration of the authorities in this country, we may assume that the opinion expressed by the Conference will carry considerable weight with the authorities here.

The first Conference met in Berlin in August, 1903, when the powers represented, with the exception of Great Britain and Italy, agreed to certain proposals to be considered at a subsequent Conference for the international regulation of wireless telegraphy. The attitude of the British delegates was governed by the fact that the Government had not that control over wireless telegraphy which would have enabled them to enforce the provisions of the Convention. Accordingly, the Wireless Telegraph Act was passed in the following year, and this prohibited the installation or working of wireless apparatus in the United Kingdom or on British ships without a licence from the Postmaster-General. In 1906 the second Conference was held, also in Berlin, and the Convention has been ratified by nearly all the countries represented. That Conference adopted a principal list of 23 Statutes for proposed ratification, a secondary list of three Articles, a final protocol of six Articles, and an Appendix of Service Regulations consisting of 42 Articles. The Appendix is the most important part of the existing Convention, and it is upon this section of the Convention that the most important discussions will centre.

Strong efforts will be made to amend Articles 2 and 3 of the Service Regulations, which specify two wave lengths of 300 *and* 600 metres for the service of general public correspondence. The normal wave length on board ship was fixed at 300 metres. Wave lengths between 600 and 1,600 metres were excluded from commercial use, and entirely reserved for Government purposes. Experience has shown that a wave length of 600 metres is more generally adopted by ship stations, because it has a wider range and is more generally suitable than a wave length of 300 metres for correspondence, and an attempt will be made to fix the normal wave length for ship stations at 600 metres instead of 300 metres, which is the present normal wave length for ship stations. Provision would then have to be made, so that each station would be equipped in such a way as to be capable of using this wave length, as well as one of 300 metres. In the opinion of some, the restriction to the present wave lengths is altogether unnecessary, and there is a feeling in certain quarters that the efficiency of the service would be improved, and interference considerably lessened, by allowing the use of any wave length which each administration might think suitable. In this case, however, it would be essential to provide for a uniform wave length for calling. Another view which will doubtless be presented, is that inter-communication between a ship station and a shore station must be conducted on both sides on the same wave length. If in any particular case there is interference, the two stations may agree to change this wave length, and at the close of the message or messages interchanged, the stations would return to their normal wave lengths. The extended use of wireless telegraphy is principally dependent upon the ease with which a number of stations can be worked efficiently in the vicinity of each other. Such interference as does take place between ships is largely in consequence of the fact that the wave lengths adopted in accordance with the rules laid down by the Berlin Convention are not sufficient, and a considerable advantage would be obtained by the utilisation of a third and longer wave.

The Conference will not deal with shore-to-shore work, which is rather surprising, considering how rapidly wireless telegraphy has developed as a means of communication between country and country. The main questions to come before the delegates will deal with communication between ship and ship, and ship and shore, and also the question of charging. The Convention stipulates that the coast charge for wireless telegrams shall not exceed 60 centimes per word, nor the ship charge be more than 40 centimes per word. A number of countries have already fixed several rates for every station, and it seems clear that a single coast or ship station charge is not elastic enough to meet all requirements. For ships on short passages, reduced rates seem essential. On the other hand, the improvement of the means of transmission has necessitated more powerful, and consequently more costly, stations, to which it is reasonable to grant a fair remuneration for their work. Under the circumstances, it seems reasonable to make the charges proportionate to the distance, as is usually the case with ordinary telegraphy. The highly complex matter of accounts will doubtless be the subject of a great deal of discussion. When a message is communicated through a number of different stations, the fee for transmission has to be divided amongst them, and with the growth of the system this has been found to give rise to a considerable amount of difficulty. It is hoped that some simpler system may be devised.

Questions in which the French Government are particularly interested are the organisation of a time service, by which the shore time would be communicated to ships at sea, and the definition of aerial radio-telegraphic stations.

Opinion in this country has now become reconciled to the Convention. Six years ago, the opposition to ratification by Great Britain was so strong that Parliament was compelled to appoint a Select Committee to investigate the question, and the decision of the Committee in favour of ratification was only arrived at by a majority of one vote. The arguments used against ratification were that the effect of the regulations of the Convention would be to cramp and restrict invention, and make it more difficult to try or to introduce improvements, and that the adoption of the regulations would remove that proper stimulus to making great improvements which arises from the pressure of necessity by creating an artificial condition of affairs in which difficulties were covered up rather than removed. How groundless was this fear is proved by the enormous development of the system throughout the entire world. The Convention has facilitated and promoted the use of wireless telegraphy, especially for maritime purposes. It has provided international arrangements for rules of working, control, licensing of operators, efficiency of apparatus, collection of charges, transmission of messages, and publication of information. Moreover, it has provided the means of preventing confusion, and of avoiding interference between neighbouring ship and shore stations, a result impossible of attainment except by international agreement. General freedom of communication between ships and coast stations has been secured, and the protection from interference thus afforded has given free play to all systems, and has tended to the encouragement and progress of invention in connection with wireless telegraphy.

Advance in German Prices.

The increased cost of the principal raw materials in recent months on the one hand, and the discontinuance of excessively keen competition by the Bergmann Electricity Works Co. on the other, are now affecting the inland sale prices of electrical engineering manufactures in Germany, where a general upward movement appears to be in progress. A week ago we recorded an advance of 10 per cent. in the quotations charged by the makers of telephone and telegraph apparatus, and now further developments are reported. In the first place, the A.E.G. has notified its customers of a general advance of 10 per cent. on prices of machinery and apparatus, although it might perhaps have been expected that the initiative in the matter would have been taken by the Siemens-Schuckert Works, owing to the firm's recent conclusion of friendly relations on a financial basis with the Bergmann Co. Nevertheless it is understood that, although a definite decision has not yet been arrived at, the question of a general advance in selling prices is also under the consideration of the Siemens-Schuckert Works; and the action already taken by the A.E.G. will doubtless expedite that of the other leading firms in the heavy electrical engineering trade, especially as the Bergmann Co. has now also notified a 10 per cent. rise in machinery prices. In the second place, the Syndicate of Electrical Installation Firms announces that the Copper Wire Syndicate, which raised the prices of wire in April, has now resolved on a further advance of 2s. 6d. per cwt. In addition, the Syndicate of Makers of Insulated Wires, which introduced a general increase of 15 per cent. early this year and made a further addition in April, has just made a fresh advance. The Syndicate of Installation Firms states that the higher quotations existing for some months past for electrical apparatus and installation materials have been raised, so that a general advance of 10 per cent. is now in operation. Owing to these circumstances, and the improvement in the wages paid in recent years, the allied branches are said to have been seriously affected, particularly the installation branch, which is consequently compelled to make corresponding increases in its selling prices. The syndicate adds that judging from the present position of affairs, there is no prospect of a speedy reduction in prices; expectations are quite to the opposite effect. It seems that the wire lamp branch is not yet included in the upward movement. It may be that the severity of competition in this department has not yet caused some of the smaller German makers to discontinue the manufacture of these lamps.

Indian Railway Administration.

In many respects the Administration reports on the Railways in India, while vastly superior to the returns issued by our Board of Trade, are even more detailed than the returns for the United States issued by the Inter-State Railroad Commission at Washington. Quite apart from such interesting data as the load factor (of course, this term is not used) of locomotives and rolling stock, the electrical details are decidedly good.

For instance, in regard to such an important matter as train lighting, by electricity and gas, to which Board of Trade inquiries in the United Kingdom have attached much weight, any person in England spending a few shillings can ascertain how Indian passenger rolling stock is lighted. We do not know any official publication doing the same for this country. In India, 3,636 passenger coaches are lighted with electricity, 12,455 are lighted with gas, and 4,811 are not fitted for either of these illuminants. Another column sets out the names of the systems in use on each railway.

Certain Indian railways have their own electrical generating plant for the lighting of stations or for power supply to their workshops. The cost of repairs and renewals of such plant is enumerated, and is set out in its half-yearly incidence per mile of line open, per train-mile, and per 1,000 gross ton-miles, under the respective headings of maintenance of works and stations, locomotive expenses, and carriage and wagon expenses. Again, under general charges the cost of electric telegraphs is expressed as a percentage of the total earnings.

Much more might be said in praise of this admirably designed statistical system. As the understanding of statistics becomes of increasing importance, in order to appreciate in their correct significance the many complex economic questions of the day—not least those connected with transport—the study of a model return such as the one to which we have referred will be found strikingly suggestive and valuable.

Summer Meetings.

Next week the first summer meeting of the Institution of Electrical Engineers will take place at Glasgow; an interesting programme has been arranged, combining physical and mental recreation, with ample provision for intellectual edification. Glasgow is admirably qualified to be the first city to be visited, being the birthplace of many of the most important developments in electrical science, an engineering centre of the first rank, and a convenient starting point for some of the most delightful excursions in Great Britain. Besides a paper of exceptional interest by Mr. J. S. Highfield, and a lecture by Prof. S. P. Thompson, there will be visits to some of those great engineering works and power stations that are the pride of the Clyde, and the familiar but ever-enjoyable steamer trip through the Kyles of Bute to Inveraray. The three days will, in fact, be crammed with interest and pleasure, and we hope that fine weather will enable the meeting to be numbered amongst the most successful efforts of the Institution.

The following week will be occupied by the annual Convention of the Municipal Electrical Association, to which, presumably, many of the Glasgow visitors will proceed. There are, no doubt, advantages in the close succession of these two functions, but there are also obvious disadvantages, and perhaps it would have been better to space them further apart. However, that is a question for another year.

Later in the month the Tramway Convention will take place at Swansea, and at the end of July the Faraday Society will probably carry out an expedition to Norway and Sweden—surely the most attractive proposal of them all.

ELECTRICAL SIGNS AS ADVERTISING MEDIA.

By G. A. COOPER.

Of the many methods used by advertisers for drawing attention to their wares, none has received such scant attention as the electrical sign. Development in the design and form of these signs has been on a very small scale, and to-day, with one notable exception, we cannot show any real novelty in their design on the patterns in use years ago. We still cling to the beaten track in sign work, and a writing sign or a colour change, or a blink in a box sign is the highest point attained so far.

The sensation created by the advent of the "Scotchman" sign on the Embankment, and the interest it aroused, has apparently made no impression on those who should study closely the application of electrical signs, and the effect of new ideas in the all-important advertising world.

The success of this moving picture sign would lead to a natural enough deduction that advertisers were inundated by the sign builders with designs and schemes for moving picture signs, but this cannot have been the case as, however much we may lag behind other nations in this branch of advertising, the fault does not lie with the advertisers. There is no body of men so anxious to get hold of new ideas as the large advertisers, and the cost of these signs cannot be a deterrent to their use here, for the amount of money spent by individual advertisers per year would provide dozens of these signs in every large town.

Incredible though it may seem, no determined attempt has been made to establish these signs in this country, although there is nothing in the world to compare with them as advertising media. Advertisers recognise that descriptive writing up of their wares is good enough in its way, but something more is needed to fix the name of the goods in the mind of the man in the street. That is why our hoardings are covered with pictures appealing to the imagination and helping the mind to retain what the eye sees.

What the moving picture sign does is to improve upon this, and by its action and effect *compel* the passer-by to take notice; it also impresses the advertisement upon his mind in a far stronger degree than does its brother the placarded hoarding. Its extensive use in America proves beyond all dispute its advertising value, and some idea of its development there may be gauged by an account of the gigantic composite sign used in Louisville.

A huge frame flanked by two pillars contains six illuminated moving advertisements. The two columns flanking the frame are lighted by strips of light from top to bottom, and are so controlled that the columns appear to be revolving constantly. A piano advertisement occupies the top left-hand corner and depicts a lady sitting at a piano (outlined in lights). The effect obtained is that the lady at intervals leans forward and begins playing, moving her hands backward and forward over the keys.

The second and middle space on the top row is occupied by a street car and advertises the tramway service. The street car stands still for a few seconds, a gong rings, wheels revolve, track moves and trolley pole emits sparks. A furnishing firm call attention to their goods in a picture situated in the middle of the frame at the bottom, and, apart from the picture, the wording is so decidedly trans-Atlantic that its repetition here needs no apology. You are told that—

You furnish the girl,
We furnish the home;

the sentences being flashed in conjunction with a picture of a boy and girl with a wagon, both figures taking irregular steps, as if walking slowly, the cart wheels revolving and the ground apparently moving in the opposite direction. A florist's advertisement appearing on the frame shows a spray of roses gradually growing from a small stem, the leaves appearing first, then buds which open up to full bloom.

Another moving picture sign is a diving girl. The girl springs from the board, and the water splashes as she enters; then the girl disappears.

The few examples given above indicate the unlimited scope of the picture sign. There is no doubt that its general application in this country will come shortly.

Sign makers should be up and doing, or some enterprising foreigner will be here snapping up the business under their noses, and with the examples of the motor-car and aeroplane industries fresh in their minds, they should awaken to the opportunities which are now before them.

A RADIO-TELEGRAPHIC COMPASS.

[BY OUR BERLIN CORRESPONDENT.]

THE Prussian Department of Public Works, some years ago, commenced some interesting experiments intended to find out a method for determining the position of ships, dirigibles, aeroplanes, &c., in foggy weather. On the Müggel Lake, near Berlin, were installed, at fixed points, transmitter antennæ, each comprising 32 small poles placed at equal distances apart, on the circumference of a circle 650 ft. in diameter. Each pair of opposite poles communicated with a wireless transmitter situated in the centre of the circle. This transmitter was successively connected with each pair of antennæ, and a different signal was given out from each. If an ordinary acoustic receiver with non-directed antenna happened to be in the plane of the pair of antennæ actually working, this receiver would get a maximum amount of energy. As the wave-length chosen was approximately equal to twice the distance between the poles, the wave impulses emanating with opposite phases from the front and back poles respectively would add themselves in this plane. If, on the contrary, the receiver was situated at right-angles to the pair of poles, the two opposite impulses would strike the receiver simultaneously, thus neutralising one another. As each pair of antennæ (corresponding to a given position in space) gave out a different letter, the telegraph operator only had to ascertain which letter was received with a maximum or minimum intensity. The position of each station and each pair of antennæ, with its corresponding letter, being marked on a map, the directions between the ship (or airship)

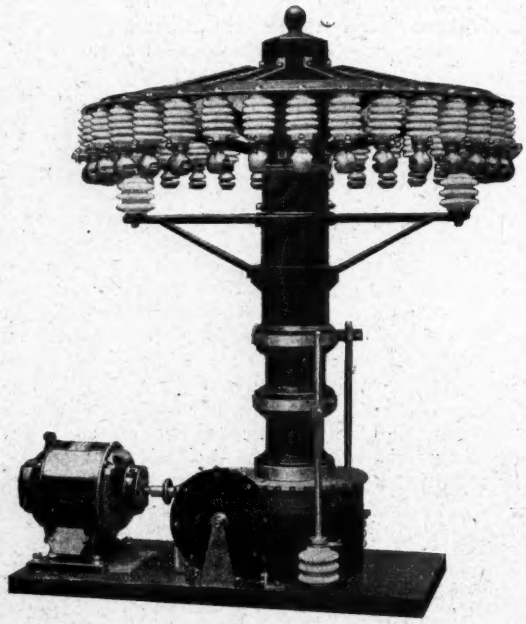


FIG. 1.—AUTOMATIC TRANSMITTER.

station and two such fixed stations would allow the position of the former to be determined. It is true that the necessity of remembering quite a number of letters and comparing the intensities of these signals put the memory of the telegraphist to considerable strain.

The Wireless Telegraph Co., of Berlin, on the basis of these experiments, developed a new method which greatly facilitates the work of the telegraphist. While retaining the general arrangement of the antennæ, another (non-directed) antenna is added (fig. 2). Before beginning an experiment, the transmitter is connected to this non-directed antenna (which gives out a short time-signal), and afterwards, by a self-acting switch, successively with each pair of directed antennæ, giving out each time a radio-telegraphic

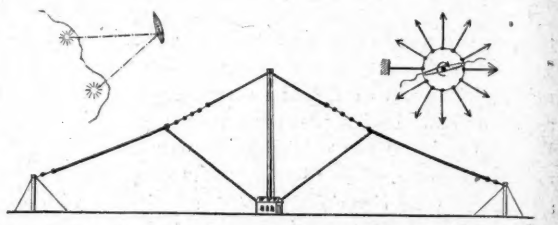


FIG. 2.—ARRANGEMENT OF TRANSMITTING ANTENNÆ.

signal. These signals are identical with one another, and always begin at a given antenna, *e.g.*, the north-south antenna, continuing in a clockwise direction at the constant speed of a stop-watch. The latter is graduated like a compass card, and works at the speed of rotation of the transmitter, its starting point being the north-south direction from which the transmitter starts its rotation. On hearing the time signal, the telegraphist presses the button of the stop-watch, and thus sets this working. At this moment, the transmitter begins giving out directed signals, first in a north-south direction, and so on, simultaneously with the rotation of the stop-watch. As soon as these signals are heard with a minimum intensity, the telegraphist stops his watch, the hand of which then marks the direction corresponding to the minimum of intensity in the reception of signals. Since each rotation of the transmitter (and the stop-watch) lasts just half-a-minute, 10 complete rotations, and accordingly 10 series of readings, are effected in five minutes. As the transmitters work quite automatically, they do not necessitate any superintendence.

If only a single stationary transmitter be available, only the direction of the receiver (on the balloon or ship), with regard to this transmitter can be determined. If, however, there be two fixed stations, the point of intersection of the two lines thus determined gives on a map the exact position of the receiver.

This arrangement, called the Telefunken compass, comprises at each sending station a vertical shaft, carrying at its upper end—on the circumference of a circle—a number of insulated contact points, communicating with the correspondingly directed antennæ. Two contacts, set rotating by an electro-motor, successively connect the 16 pairs of antennæ with the transmitter. After each half rotation the transmitter is for a moment connected to the non-directed time antenna. Fig. 1 shows the automatic transmitter.

In order to utilise this radio-telegraphic compass in the interests of aerial navigation, it has been suggested to install along the German frontier a series of fixed transmitter stations, so that the distance between these stations and an airship crossing the frontier district would at most be 30 miles. The airship passengers would thus be able accurately to determine their position and the moment they were passing the frontier. A similar series of stations installed on the north coast of Germany would protect aeronauts against the surprises of an involuntary flight over the sea. The maximum consumption of power of each station would be ½ KW., which could be derived from existing supply stations. Chimneys or the like could in most cases be used to carry the antenna systems.

Barking Electricity Supply.—The agreement with Messrs. Lawes & Co. for the supply of electricity for power purposes is to be extended for a further period of one year. The electrical engineer reports a breakdown of the 400-KW. engine at the electricity works, and states that the supply was maintained by arranging with two large consumers to limit their demand.

A NEW ELECTRIC LIFT.

Electric lifts, or elevators, have become a most important factor in everyday life; the wide ramifications of electric supply mains, and the supplanting of old buildings by large modern edifices, are doing much to popularise them, and it is hardly an exaggeration to say that whenever a new lift is installed, in 99 cases out of 100 it is an electric one. It is not only in institutions and buildings devoted to business purposes that the electric lift has become so widely adopted; every modern residential flat invariably has one, and there is a growing tendency to use them in private houses, not only for domestic purposes, but also for passenger service.

The latest firm of our acquaintance to enter into the electric lift business is that of Messrs. Scholey & Co., who have entered into an alliance with Messrs. Graham Bros., of Stockholm, who are among the most expert lift makers in the world.

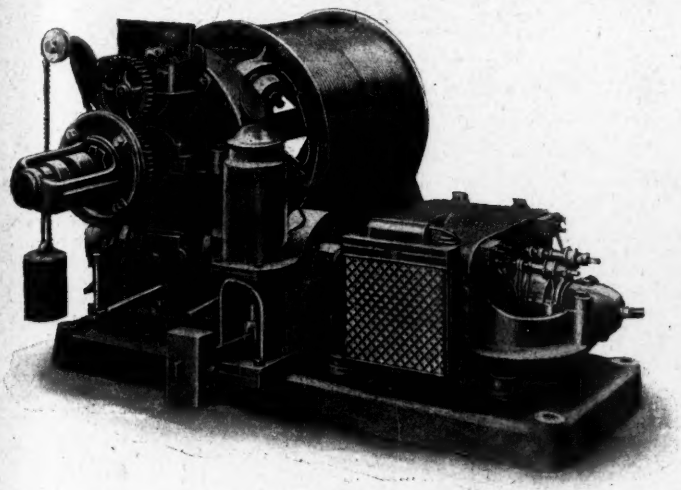


Fig. 1.—Winding Gear with d.c. Motor, showing Overwinding Device and Electric Brake.

A lift which has been installed at 151, Queen Victoria Street, by Messrs. Scholey & Co. serves to demonstrate two systems of control—namely, the ordinary car-switch control and the push-button method—either system being used as the necessity arises. The lift traverses four floors. The whole of the driving gear is placed in the basement, and consists of a special type of d.c. motor working

Fig. 3.—View of Lift.

on 200-volt supply, and driving the rope drum through special worm gearing. The motor is an interesting variation from ordinary practice, but the design has been arrived at after long experience as being the most suitable on the score of reliability and noiseless running. Electric lifts have frequently been the subject of complaint on the score of noise, and while in some cases this may have been due to badly fitting gearing, a good deal of the noise very often proceeds from the motor. The Graham motor is stated to be specially built to guard against this trouble, and the performance of the motor and gearing on the lift we are describing is an example of noiseless operation.

The drum is carried on a shaft of special quality steel; the worm and wheel are of high-grade material and are cut from the solid, thus ensuring perfect action. Placed alongside the driving gear is the switchboard on which are carried the main switch fuses, the relays for the push-button service, and four contactors, which are common to both the car control and the push-button control.

While safety in operation has been specially considered in both systems, there are one or two notable safety devices in connection with the push-button control. One is the overwinding gear, so designed as to operate if the cage from any cause should run above or below the top or bottom floor level. This overwinding gear has some points of resemblance to the well-known gear used on colliery winding plant.

On an extension of the main shaft a worm is carried, the length

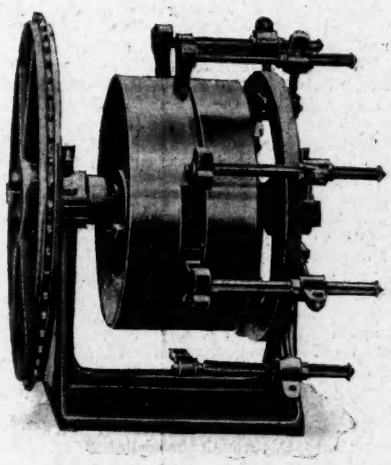


Fig. 2.—Push-Button Control Drum.

of which is made to correspond to the travel of the cage. During the operation of the lift a large block nut traverses the worm, and in the event of the cage travelling beyond the normal

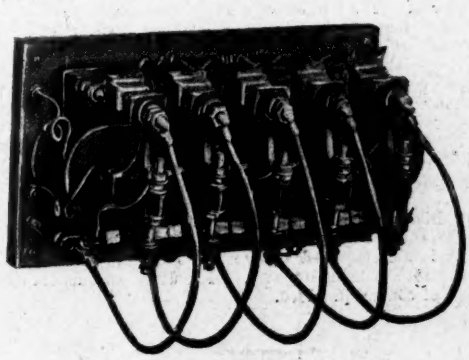


Fig. 4.—Row of Contactors.

limits, this nut would engage with a catch and turn a contact ring (upon which carbon brush contacts are arranged) to such an extent that the brush would pass on to an insulated portion, thus

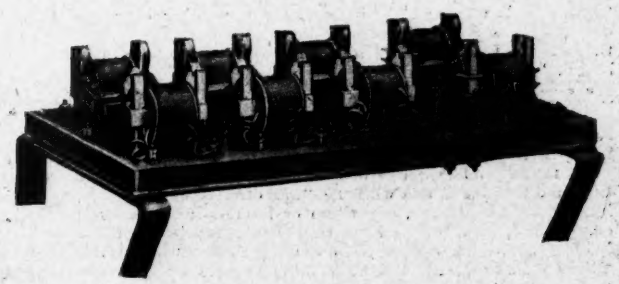


Fig. 5.—Set of Relays.

interrupting the circuit. The contact rings, of which there are two, are so arranged that one ring has a slight lead over the other. The first one is connected in series with the contactor circuit, and

with the interruption of this circuit the cage would immediately come to rest. If by any chance the contactor were to stick, the main circuit would be interrupted at the second ring. The action of the overwinding gear also lifts a counterweight which has the effect of resetting the apparatus, so that when the overwinding has been prevented, on restarting the gear the weight descends and turns the contact rings to their normal position.

Another safety device which is worth noting is an automatic slowing arrangement. This is designed to come into action when the lift is operated by the ordinary car-switch control, travelling at 200 ft. per minute. In circuit with the main switch control are a series of ring contacts which are fitted on the end of the drum shaft, and operated by a reduction gear. The purpose of this device is that if the lift man by any chance should forget the floor he was approaching, the cage would be slowed up and stopped automatically at the top or the bottom.

The gear is fitted with an improved form of band brake, which is operated by a solenoid specially wound for elevator service. The brake is released by exciting the solenoid, which lifts an armature connected to a lever fitted with an adjustable weight, giving a large margin of adjustment. Further, there is fitted a switch which comes into operation immediately the brake is operated or lifted, this switch being opened automatically by the armature of the solenoid. By the operation of this switch a resistance is inserted in the solenoid circuit, thus reducing the current to a value sufficient to hold the brake off, and preventing the solenoid from being overheated by the continual working of the brake.

The push-button system of control provided appears to be as safe as human ingenuity can make it. A series of push buttons are carried in the car, each of which indicates a given floor. The operation of any one of these buttons will cause the car to proceed automatically to the corresponding floor. It is impossible to open any gate until the cage is completely at rest; further, the gear will not move until the gate has been properly closed, the closing of the gate completing the circuit, by which alone the lift will respond to the push button, and if any of the gates on any floor were not properly closed, the car would not travel.

The operation is as follows: As soon as the button is pushed, a relay keeps the circuit closed until the cage arrives at the floor desired. The circuit is maintained and broken in the following manner. A contact maker consisting of a split drum is driven from the main shaft, through the medium of a chain and sprocket wheel. Round this contact drum are arranged a number of arms carrying copper gauze contacts, an arm corresponding to each floor. Whenever a button is pushed, the relay closes the circuit, and current flows through the arm and the drum with which it is in contact. The contact drum is mounted on a screw, and, during the period of rotation, travels for a short distance in a lateral direction; the effect of this is that a small opening cut on the face of the drum passes sooner or later under each contact, and if such contact is in action, the circuit will be broken directly the gap in the drum face passes under it. The length of lateral travel depends entirely on the number of floors controlled. For instance, if the push button for the first floor were in operation, the control drum would only move a comparatively short distance before the contact arm (corresponding to that floor) came to the gap in the drum, and thus broke contact. Clearly, the act of breaking contact would coincide with the cage having reached the floor which was under control.

A distinctly new feature is the use of a second push-button arranged at each lift gate, by which the car is returned automatically to the ground floor.

The car-switch controller is very much on the lines with which we are familiar, an important point, however, being the provision of renewable contacts.

The gear is also supplied with an A.C. motor, in which case the brake is actuated by a small motor. The usual mechanical safety devices are, of course, provided.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"INQUIRER" writes:—"Is it legal for a member of a public board, who is a director of a public liability company, to vote in the interest of his company in the letting of a contract by that board?"

*** This brief query raises a question of considerable interest and importance. That the danger alluded to was foreseen when large powers were conferred upon the local authorities is manifest; for by Sec. 12 of the Municipal Corporations Act, 1882, it is provided that a person shall be disqualified for being elected and for being a councillor if, and while he "has directly or indirectly, by himself or his partner, any share or interest in any contract or employment, with, by, or on behalf of the Council." The fact that holding shares in, and, *a fortiori*, being a director of a company which contracts with the Council, is emphasised by a special exemption. Thus, a person is not disqualified, or deemed to have any share or interest in such a contract or employment by reason only of his having any share or interest in "any company which contracts with the Council for lighting or supplying with water or insuring against fire any part of the borough. In the case of an urban district ('Inquirer,' by the way, does not specify the nature of the district in which he is interested), it is provided by the Local Government Act, 1894, Sec. 46, that a person shall be disqualified for being elected or being a member or chairman of a Council if he is concerned in any bargain or contract with the Council; provided that a person shall not be disqualified by reason of being interested in any contract with the Council . . . as a shareholder in any joint stock company; but he shall not vote at any meeting of the Council . . . on any question in which such company are interested, except that in the case of a water company or other company established for the carrying on of works of a like public nature, this prohibition may be dispensed with by the County Council." Having regard to what has been said, it seems that "Inquirer" could successfully protest against the director exercising the right to vote; any rate, can easily be identified.

PROCEEDINGS OF INSTITUTIONS.

The Behaviour of Direct-Current Watt-Hour Meters.

By S. W. MELSOM, A.M.I.E.E., and W. H. EASTLAND.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *London, May 9th*, 1912.)

IN view of the questions which are constantly being raised as to the behaviour and accuracy under working conditions of direct-current watt-hour meters of various types, more especially regarding those used for measuring traction and other power loads, the authors have investigated at the National Physical Laboratory a number of these instruments, each of a different type, in order to ascertain, if possible, the source of the differences which undoubtedly often exist between meters of different types when used to measure power in the same circuit. The size of meter selected for the tests was for 200 amperes at 480 volts.

PARTICULARS OF WATT-HOUR METERS TESTED.

Allgemeine Electricitäts Gesellschaft	Oscillating type.
Aron Meter Co.	Short pendulum meter.
British Thomson-Houston ...	Motor type with external (copper) resistance and shielded brake magnets.
Chamberlain & Hookham ...	Shunted mercury motor type.
Everett Edgcumbe	Shunted motor type with external (Eureka) resistance in pressure circuit.
Evershed & Vignoles	Motor type.
Siemens Bros.	Motor type.

With a view to determining any change in calibration with time, the meters have now, by the kindness of Mr. A. V. Mason, been connected in the traction circuit of the Sutton station of the South Metropolitan Tramways Co., where their behaviour will be noted under ordinary working conditions.

For the measurement of the quantity of electricity flowing through the main circuit of the meter, a copper voltameter was specially constructed to take the full current continuously. In order to ensure that the deposit was even and homogeneous, the electrolyte was kept agitated by means of a current of air, which served also to keep the temperature down, the maximum rise at the end of a 2-hour run being not more than 3° C.

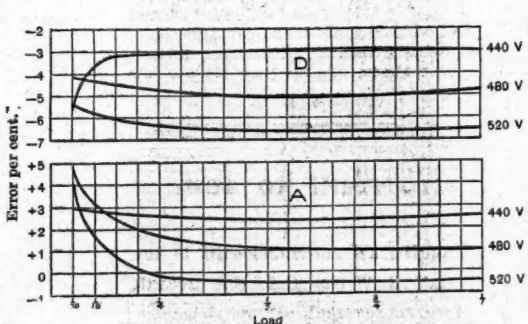


FIG. 1.—CURVES OF ERRORS AT DIFFERENT VOLTAGES.

The time over which each variable load test extended was not less than 2 hours, the voltage on the meter-pressure circuits being maintained at 480 volts during this time.

Before the tests with varying loads were commenced, the meters were thoroughly tested at intervals over a period of three weeks by short-run tests made by counting the revolutions of the rotor over a time of approximately 100 seconds, and by dial readings taken over runs of several hours at full load. Short-run tests were also made both immediately before and after each test on variable load.

The results obtained with the meters on steady load were not always consistent nearer than within ± 1 per cent. The mean of the constants obtained with the variable load agree with those

obtained on steady load to within these limits, and show conclusively that for all practical purposes there is no difference between the behaviour of any of the meters with a steady or a rapidly varying load: this confirms the conclusions of Messrs. Orlich and Günther-Schulze.

As a final check observations were taken over the first three weeks during which the meters were erected at Sutton. The load varies between 0 and 100 amperes, with occasional kicks to 300 amperes. The average current, determined by a mean of the meter readings, was about 50 amperes. The B. of T. units recorded by the meters, after being corrected in each case by the constant previously obtained at the laboratory, are given in column 1 of the following table, and the divergence of each meter from the mean of the whole six in column 2. It will be seen that the record of each meter agreed with the mean value to within ± 1 per cent., and in view of the fact that the average load was only equal to about one-quarter of the normal full load for the meters, and the possible error in testing was ± 0·5 per cent., this must be considered as very good agreement.

	(1)	(2)
Aron	7,605	+ 0·6 %
B.T.-H.	7,590	+ 0·4 %
C. & H.	7,520	− 0·5 %
Everett-Edgcumbe	7,500	− 0·8 %
Evershed & Vignoles	7,560	0
Siemens	7,570	+ 0·1 %
Mean	7,560	

During the period of eight months covered by the tests the meters were twice dispatched on journeys—once by goods train to Tynemouth and back, and once by carrier to London. One meter was, unfortunately, injured in travelling to Tynemouth, and this necessitated it being recalibrated, but otherwise there was no appreciable change in the calibration of any of the meters as a result of the travelling.

In the majority of cases the meters were consistent during the whole time to within about ± 1 per cent., the variation being in general rather more at the lower loads. In one case, however, the rate decreased by about 3 per cent. at all loads during the first six weeks, but after this time remained constant to within + 1 per cent. With another meter the results obtained towards the end of the time varied by about ± 2 per cent. from day to day.

The meters were practically unchanged at the higher loads as a result of the month's work at Sutton; at the lighter loads, however, some fairly large changes did in some cases take place. The changes coincided with a period during which the circuit breaker at the station came out several times owing to short circuits or other causes of excessive current, and this seems to confirm the conclusions of A. Durand, and also the results obtained with other meters at the National Physical Laboratory, that when a momentarily excessive current is passed through the meter the iron shield used to protect the brake magnets becomes slightly magnetised and affects the accuracy at light loads.*

The curves in fig. 1 show the errors of two of the meters at normal voltage and at a voltage 10 per cent. above and below the normal. The changes are perhaps not excessive, but are large enough in some cases to require a correction if an accurate record is required at a voltage different to that at which the meters are calibrated.

So far as the authors are aware, no very definite data have been published as to the extent of the stray fields to which meters may be subject in generating stations. Experiments were, therefore, made by means of a coil carrying a current which was adjusted so that the field was equal to that which would be produced by a straight conductor carrying 1,000 amperes placed at a distance of 2 ft. from the meter. The curves, fig. 2, show the results obtained with one of the meters when this field was placed in the position at which it produced the maximum change—*i.e.*, in the position most unfavourable to the meter. In the case of one meter there was no change in the rate owing to this field, and in another the difference was very small. In the cases of the other four meters, however the changes at light loads are large, and it is obvious that this question is one of the greatest importance. Difficulties of this sort can be met by erecting the meters in such a position that they will not be exposed to large stray fields.

The curves, fig. 3, show the results obtained with one of the meters when mounted 3° out of level; the errors at light loads are in most cases increased largely, while in one case the error at full load was altered by about 2 per cent.

The temperature coefficient of all the meters tested was in no case greater than ± 0·1 per cent. for a change in temperature of 1° C., an amount which is probably negligible for most practical purposes.

Often a meter is put into a circuit the current in which rarely, if ever, reaches the maximum, the average load being often equal only to one-tenth of the full load for the instrument. This practice is not very satisfactory. It would be far better to install at first a meter of small capacity, adding when the load increased another meter of the same size connected in parallel with the first, or replacing it with a larger meter.

Care should be taken to erect meters, especially those having a temperature coefficient, well away from any extraneous sources of heat, such as field-regulating resistances or switchgear. Where the added resistance in the shunt circuit of the meter is wound of copper wire and mounted in a separate box, it is important that the box should be placed in such a position that it will be subject to the same temperature variation as the meter, and will not be heated from an extraneous source of heat, or cooled by being placed in an air draught.

The possibility of stray fields should be carefully considered in selecting the position for erection; there may be very large fields in the vicinity of the angle-iron frame on which switchboards are usually mounted, and near large circuit-breakers of the magnetic type. When the meters are erected a simple test can be made to ascertain if any stray fields are affecting the meter by disconnecting the main

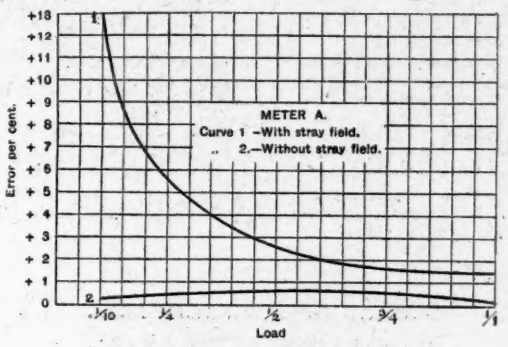


FIG. 2.—EFFECT OF STRAY FIELD.

current leads from the meter and short-circuiting them, the voltage circuit being left connected across the mains. Under these conditions the effect of any stray field should be shown by a movement of the meter dials.

The main current leads to the meter should be run with the lead and return close to each other. Great care should be taken to see that good contact is made at the meters, as otherwise errors may be introduced into the readings owing to the rise of temperature in the instrument; this is a matter of great importance in the case of shunted meters, where bad contacts may lead to very large errors. In the cases of two meters recently tested in the condition in which they were received it was found that in one (a 4,000-ampere meter) the watts lost in the contacts were almost equal to those dissipated in the instrument itself, and that the rate of the meter, after it had been run for 1½ hours, had increased by about 5 per cent.; and in another (a shunted meter), when first tested, the reading was found to be 30 per cent. too low, while after the contacts were cleaned it was correct to within 2 per cent.

A slight difference in level affects seriously only the accuracy of the lower loads; as, however, it is important that these should be accurate, it is desirable that the meters should be carefully levelled. Aron clock meters can be levelled by the small plumb-bob fixed inside the case, and motor meters by the well-known method of placing a coin or small weight on the outer periphery of the meter disk and adjusting the meter level so that the weighted disk does

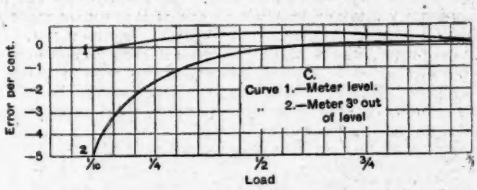


FIG. 3.—ERRORS DUE TO CHANGE OF LEVEL.

not move when the meter case is tapped. In the case of the oscillating-type meter, where the disk is not able to make a complete revolution, the method adopted by the authors was to time two oscillations with a small steady current, the level of the meter being adjusted until the time of oscillation was the same in each direction.

With most of the types of direct-current watt-hour meters it is possible to obtain under proper conditions an accuracy of test to within ± 0·5 per cent. This, however, probably applies only where the measurements of current and pressure are made directly by a potentiometer. Where direct-deflection instruments are used for the measurement of power the possible error is of necessity somewhat larger, and the accuracy of tests under these conditions cannot be considered as being nearer than ± 1 per cent. Speaking generally, direct-current watt-hour meters are consistent to within ± 1 per cent. at the upper loads, and it is clearly shown by the results obtained at Sutton that the records obtained under working conditions when corrected by the constants obtained by the tests should be correct nearly to within this limit. In the case of a meter used to measure a large output, it is recommended that it be tested and, if necessary, cleaned and adjusted once every six months.

In making tests in the laboratory or test-room, the pressure circuit should be connected to the mains for several hours before commencing the test. This applies more particularly to those meters in which the series resistance is of copper and is situate inside the meter. One hour is not sufficient for the various parts of a meter to attain to a constant temperature.

* A later examination seems to indicate that it is the steel spindle that has become magnetised and is affecting the accuracy of the meter at light loads

In addition to the usual test at various loads, made preferably with a chronograph as distinct from a stop-watch (chronograph is the name generally given to a centre seconds watch, the hands of which are put in and out of gear with the movement, while by the "stop-watch" is meant a watch in which the whole movement is stopped or started), it is necessary that the meter should be run for a considerable time at full load in order to ascertain the extent of the error due to heating. The main portion of the heating will take place in the first hour, and a short-run test taken at the end of that time will indicate very well whether the test need be continued further. In more than one meter tested by the authors, the accuracy changed by about 5 per cent as a result of running for five hours on full load.

Tests made in position are often of very little value. In the authors' opinion there is no direct-current meter at present on the market which can be relied upon to integrate a load sufficiently accurately to be used as a standard by means of which other meters can be checked. It seems to be most satisfactory to erect the meter in such a position that it is unaffected by stray fields or anything else which may impair the accuracy, and to have it tested from time to time under conditions, both as regards apparatus and time, in which the errors can be accurately determined and any special points fully investigated.

Electrical Meters on Variable Loads.

By DAVID ROBERTSON, B.Sc., A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *London, May 9th*, 1912.)

THE paper deals both theoretically and experimentally with the behaviour of electricity meters on variable loads. It is shown that an eddy brake meter without fluid friction and with perfectly compensated solid friction is correct on all loads whether steady or not; the extra record made during deceleration always exactly compensates for that lost during acceleration.

Solid friction makes the loss of record while the speed is rising exceed the gain while it is falling; while fluid friction, even if compensated for steady loads, has the reverse effect. The proportional starting and stopping error due to solid friction increases indefinitely as the duration of the load is made less and less, while that caused by the fluid friction only approaches a finite limit of the same order as the amount of the friction itself.

On a rectangular-wave cyclic load, the error due to solid friction is constant at all frequencies above that at which the rotor just comes to rest each cycle, and is such as to make the meter run at the same speed as it would with a steady load equal to the mean. The fluid friction error increases with the frequency, but is less than the starting and stopping error.

Experiments made at the Merchant Venturers' Technical College, and on the Devonport and District Tramways are described, and the results given and discussed. They confirm the theoretical conclusions, but show that the effects are small on a tramway load.

As is well known, the law connecting the resisting torque with the speed of a motor meter must be the same as that connecting the driving torque with the current, or power, being metered, if the meter is to be accurate on all loads. This agreement can only be approximately attained in practice, but if it could be made perfect, then, however complex the law might be, the meter, when properly calibrated, would be correct on all steady loads and also on all variable loads which change sufficiently slowly to make the inertia torque negligible. But it would not necessarily be accurate on loads which vary sufficiently rapidly to produce appreciable inertia torques on the rotor of the meter.

In ordinary meters we can conveniently divide the resisting torque into three components—solid friction torque, eddy-current torque and fluid friction torque—and assume these to be respectively constant, proportional to the speed and to the square of the speed. None of these assumptions is quite true, but within certain ranges for each the deviation can safely be neglected. The solid friction increases very considerably at low velocities, especially when the speed is almost zero. The eddy-current torque increases less rapidly than the speed at high speeds and reaches a maximum at a certain speed, beyond which it diminishes, owing to the inductance of the eddy-current paths; at all ordinary meter speeds the reactance effects are quite negligible, and the deviation from the proportional law is inappreciable. Fluid friction changes law at a certain critical speed which depends on the constants of the fluid; below that speed the fluid frictional torque is proportional to the speed instead of to its square.

In practically all modern motor-meters the main control is an eddy-current brake. When the solid friction is exactly compensated and fluid friction absent, the mean current or power being metered will be strictly proportional to the mean speed, and the meter, if properly calibrated, will always record correctly whether the load changes rapidly or slowly, whatever the wave-form of the load may be, and however much inertia the rotor may have. Its steady load characteristic is a horizontal straight line. Solid friction alters this into a rising curve. Under the worst conditions likely to occur in practice, the variable load error, compared with the rate at maximum load, is of the same order as the ratio of unbalanced frictional torque to the eddy-brake torque at the speed corresponding to the maximum load; it gets less as the load on the meter is made greater.

In electrical energy meters (watt-hour meters) the solid friction is generally compensated by putting some field turns in the shunt circuit, so that there is always a driving torque, whether there is a load or not. With the object of getting a low starting current, the position of these coils is generally adjusted so that the rotor will just not continue to rotate when the load is removed. Creeping is then liable to occur if the meter be removed to a place where it is subject to vibration, or where the voltage is above normal, and the solid friction is, as a rule, considerably over-compensated at the running speeds. Owing to the variation of the solid friction, perfect compensation can never be obtained in this way, and so they are generally under-compensated at low loads and over-compensated at large ones.

When there is fluid friction, but no solid friction, the steady load characteristic becomes almost a straight line sloping downwards. The fluid friction can be more or less compensated for steady loads by a series coil which alters the division of the flux between the motor and brake portions in such a way as to diminish the eddy-current torque relative to the driving torque at the larger loads. But even if this adjustment were perfect at steady loads, the meter would run faster than it ought at variable loads. The limiting error, whether starting and stopping or on a cyclic load, is of the same order as the ratio of the fluid friction torque to the eddy-current torque at the speed corresponding to the maximum load, and it is *greater* for large loads than for small ones.

When both solid and fluid friction are present, the characteristics are intermediate between those considered. Each kind of friction tends to correct the errors due to the other. The curve for 5 per cent. solid and 1 per cent. fluid friction would give an excellent steady load characteristic, such as that obtained from the modern Ferranti meter. It should be remembered that the proportion of each friction with a given meter varies with the load.

In the experiments a variable current was passed through the main coils of all the meters, while a constant voltage was maintained on the shunts of the energy meters. The electricity passed through was measured by a copper voltameter, and the voltage by a Nalder volt potentiometer and Weston cell.

A complete calibration of the meters with a steady load was made before commencing the variable load tests, and steady load tests at 5 and 10 amperes were interspersed at intervals.

The experiments were devised so as to magnify any variable load peculiarities which might exist, in order to make certain of detecting them. Consequently the errors which are likely to arise in actual use are very much smaller than those shown by the curves obtained.

The meters tested were of the Ferranti, Hookham, Westinghouse, Electrical Co., B.T.-H., Siemens and Aron types, and the tests were conducted with intermittent direct current at frequencies up to 600 cycles per minute.

Experiments were also made by the author at the Devonport District Tramways switch-house. Standard B.T.-H. and Aron meters of 200-ampere size, known to be in substantial agreement on steady load, were placed in series with a tramway feeder whose load was within their range. Readings were taken hourly during the first day, and daily for some time afterwards. At first the Aron meter ran very slightly faster than the B.T.-H., but after some rather heavy traffic the latter began to recover its position, and by the end of the day the records agreed within 1½ parts in a thousand. This close agreement between two meters differing so widely in their construction and principle of action was taken as conclusive proof that neither of them behaved appreciably differently on a tramway load from what they did on a steady load.

Clock meters in which there is little damping of the pendulums are as accurate on variable as on steady loads except within a small range of load frequency in which resonance effects occur. This type of meter should not be employed on cyclic loads, such as flashing signs, unless the load frequency differs considerably from that of the pendulums (about 80 cycles per minute).

JOINT DISCUSSION.

A joint discussion on the above papers was opened by MR. A. P. TROTTER (B. of T.), who said that some of their tests of tramway meters had been criticised because it was urged that they were not conducted on traction loads; he had felt the importance of the matter, which involved large sums of money, and he believed now there were two fairly good travelling meters which were quite satisfactory. If two meters of different types could be run in series on traction loads and found not to vary more than 1 or 2 per cent. over some weeks, this was not a fluke, and he felt, after hearing the papers, that good meters tested on steady loads in the laboratory were suitable for practical traction work. He disagreed with Dr. Robertson's general condemnation of mercury meters, which, under proper conditions, were exceedingly good instruments.

MR. G. H. HOLDEN said he had not had any opportunity of carrying out such tests as the N.P. Laboratory, and felt that their tests were of great value. Prof. Robertson had employed a rather obsolete type of Hookham meter in his test, and this explained his results to some extent.

MR. C. A. BAKER said that, although traction meters did not come his way, numerous variable load meters for signs passed through his hands. Variations in calibration coefficients due to temperature change offered considerable scope for study; a good average speed increase for small D.C. meters was ·3 per cent. per degree C. rise in temperature, but he agreed with the author's figure for the meters they were considering. The temperature effect for A.C. meters was much less.

DR. A. RUSSELL said he had taken the best types of tramway meters, properly adjusted, and tested them in series on fluctuating loads and interrupted circuits, but found, as he had expected, uniform readings. As such meters gave varying results when in series on the switchboard, the discrepancy was studied and traced generally to stray fields, even pendulum meters and those with

astatic coils being affected. Vibration also caused errors. Meters for traction work were admirably made now and if put up properly would agree amongst themselves. It was no good sending a switchboard meter to the laboratory for testing, and expecting laboratory results when replaced on the board. He commended Prof. Robertson's paper, but had found some difficulty in understanding the appendix owing to the notation.

MR. A. J. CRIDGE said, referring to Mr. Melsom's paper, that it would be found that astatic windings in motor meters would largely obviate trouble with stray fields, while aluminium spindles in oscillating meters would get over the trouble. He asked if the 4,000-ampere meter was tested again after it had cooled down, and was the result the same. Prof. Robertson's tests, although he found no fault with them, were of little practical value.

MR. J. RENNIE said Prof. Robertson's paper should not be taken seriously as regards some of the results arrived at. His arrangement for holding the plates of the electrolytic cell was not so good as that shown by Mr. Melsom. Manufacturers should publish approved specifications and curves of accuracy for their meters, which they would be prepared to guarantee, as this would impress the user. The carriage question had exhausted their ingenuity; he considered from his experience that meters could travel without damage. The central station often did not appear to appreciate the meter, judging by the treatment given to it, and he thought that possibly a good looking meter would get better treatment than an ordinary one, judging by the experience of the gold watch.

MR. ROGER T. SMITH said railway people would be indebted to the authors for deciding that a large number of meters were correct on variable loads if properly installed and used. He described the fairly accurate results obtained by using two permanently installed meters and one calibrating meter in series on the Great Western Railway supply. The error was under 2 per cent. on a 16 days' test and almost negligible on a 6 days' run. The calibrating 4,000-ampere meter was sent periodically to the N.P. Laboratory for overhaul. Each sub-station had one spare meter which could be removed; permanent meters were adjusted on site to within about 1 per cent. agreement.

MR. A. P. YOUNG (in a communication) said that meter theory showed very clearly that the accuracy of a motor meter having eddy-current damping and no uncompensated friction was quite independent of whether the load was steady or fluctuating. The General Electric Co., of U.S.A., some 16 years ago carried out tests on the well-known Thomson watt-hour motor meter, which proved that the theoretical conclusions were justified in actual practice. These experiments were confirmed by the more elaborate and refined tests made by Mr. Melsom and Mr. Eastland, also by those of Prof. Robertson made on the B.T.-H. type "C" and type T.S. meters. "Any motor-meter to measure the product of some quantity (A) and the time (t) will record correctly, regardless of how (A) varies, provided that :—(1) The driving torque is directly proportional to A; (2) the retarding torque is directly proportional to the angular velocity of the moving system, and there is no extraneous friction or damping not in conformity with this law. This is at once apparent from the equation of motion governing such conditions—

$$K.A = I.\,dw/dt + K_1 w,$$

where, I = moment of inertia of the moving system; w = angular velocity of the moving system; K and K_1 = constants. Multiplying through by dt and integrating—

$$K.\int_{T_1}^{T_2} A.\,dt = I\int_{T_1}^{T_2} dw + K_1\int_{T_1}^{T_2} w.\,dt,$$

i.e.,
$$K.\int_{T_1}^{T_2} A.\,dt = I\,(w_{T_2} - w_{T_1}) + K_1\,(\theta_{T_2} - \theta_{T_1})$$

If it is assumed that initially at time T_1 the moving element is at rest, and also at the final time T_2 it has again come to rest, then—

$$w_{T_2} = 0 \text{ and } w_{T_1} = 0,$$

therefore
$$K.\int_{T_1}^{T_2} A.\,dt = K_1\,(\theta_{T_2} - \theta_{T_1}).$$

The quantity on the left-hand side of this equation is that which has to be measured, whilst that on the right-hand side is proportional to the total angle moved through by the moving system, that is, to the number of revolutions made in the period from T_1 to T_2." As regards ampere-hour motor meters of the mercury type wherein eddy-current damping is employed, the extraneous damping produced by mercury friction was not a negligible factor, and in all three types of meter a compounding coil was introduced for the purpose of compensating for the mercury friction, more particularly on high loads, where it became of increasing importance; the writer suggests that the error results in most part from this compounding coil, as a result most probably of some hysteresis effect in the magnet system; that is, that true compensation is not achieved, and the deleterious effect of mercury friction manifests itself by causing the meter to read considerably more than it should do. He considers it unfortunate that Prof. Robertson did not carry out tests on the mercury meter manufactured by the B.T.-H. Co., wherein no compounding device of any kind is employed. As mercury type ampere-hour meters are being used more and more for tramcar service, it would appear that meters in which compounding is employed are not so suitable for this class of service as that type in which the design has been so well carried out that a compounding device is found quite unnecessary. Reverting to Mr. Melsom's paper, that part dealing with the "Effect of Stray Fields" was exceedingly interesting, but it was unfortunate that tests were not made on any astatic type meters. Above 500 amperes all D.C. watt-hour meters manufactured by the B.T.-H. Co. were of the astatic type, and they were, therefore, unaffected by uniformly distributed stray magnetic fields in the region of the two armature coils.

MR. S. W. MELSOM said (in replying) that Prof. Robertson had asked him to state that his conclusions were based on an old-type Hookham meter. He thought that no meter was thoroughly astatic, and he had not traced any particular effect from vibration. The 4,000-ampere meter, tested after cooling, showed exactly the same results as before. The N.P. Laboratory had found no effect on the accuracy of meters from journeys; the most severe test was a journey from Teddington to London by carrier. As regards standard meters, it was a question of having one meter and regarding it as right when others disagreed. He did not agree that any one meter was specially competent to detect errors in the others; no meter on the market was twice as good as any other.

Location of Icebergs by a Recording Microthermometer.

THE evening meeting of the ROYAL INSTITUTION on May 31st was occupied with a lecture by PROF. HOWARD T. BARNES, F.R.S., the distinguished Canadian physicist. His subject was the detection of icebergs in navigation, and the lecture was in the nature of a peroration to a series of Thursday afternoon discourses, in which he has discussed ice formation in Canadian waters, the work of ice-cutters on the St. Lawrence, and the need of bringing the wisdom of the laboratory to bear upon the safety of the northern route between Great Britain and Canada, which crosses the iceberg track. He started his experiments, he said, with scepticism, and ended them with optimism.

The lecture began with a lucid description of the shifting ice on the western shores of Greenland and its movement out to sea, where it formed the floating bergs, measuring in some cases 250 ft. from the surface of the sea to the pinnacles and 500 yards in length. Prof. Barnes endorsed Pettersson's theory that ice, melting in the sea, caused three currents to be set up, the cold sea water falling, the warmer sea water melting the ice and taking its place, and fresh water from the melted ice rising on the surface around it, but not mixing with the salt water. Scientific advantage might be taken of this last phenomenon, and the presence of fresher water be indicated by altered electrical conductivity. The "ice blink" and other signs of an iceberg's approach were more interesting than precise, and temperature changes in the sea had not hitherto been reliable owing to the crude methods of reading in vogue.

But Pettersson's theory that some temperature effect would be produced by currents of fresh water from the melted ice suggested the idea of a recording microthermometer. An instrument was required which should be sensitive enough to record a variation of temperature of a thousandth of a degree as easily as an ordinary thermometer would record a variation of 2°. After many attempts and failures, Prof. Barnes succeeded in evolving a form of electrical resistance microthermometer which would register variations otherwise entirely overlooked, and would indicate the presence of an iceberg at a distance of half a mile. The thermometer itself was fitted in a special iron cylinder attached to a guy rope for immersion in about 5 ft. of water and connected by wires to the recording instrument on deck. A portable form of galvanometer of somewhat special construction was employed, and its clock mechanism was so arranged that it would work anywhere and, indeed, worked better when there was vibration, the vibration destroying any false balance. The recording instrument contained a chart mounted on cylinders, on which a pen recorded the temperature.

A series of microthermometric charts, some made in the North Atlantic only a month ago, showed how changes of temperature denoted the presence of icebergs. The characteristic changes and the rate at which they took place were more significant than the temperature *per se*. Generally there was a rise as a ship drew near a berg, followed by a sharp fall, and a rise after the berg had been passed. The first rise was probably due to absorption of the sun's heat by fresh water from the berg. According to one chart, this iceberg effect was observable even in water at a depth of 16 ft. below the surface.

Private House Lighting by Electricity.

By W. R. RAWLINGS.

(*Abstract of paper read before the* ILLUMINATING ENGINEERING SOCIETY, *April 16th*, 1912.)

THE problem of the illumination of a mansion is entirely different from that of an institution, club or hotel. It might be supposed that the production of artificial daylight was the ideal illumination; but even if such light could be obtained at a low price, it is, in my opinion, unsuitable for the home, and should be confined to certain special applications, in cases in which the correct matching of colours, &c., is an all-important item. One desires the warm tone which the artificial illuminants of to-day naturally provide. From this standpoint the old carbon-filament lamp, with its yellow rays, gives greater satisfaction and a more pleasing effect than the white light of the metal-filament lamps.

The problem of house illumination is not so much one of foot-candles, as of convenience, taste, and personal requirements.

I admit that there is a minimum limit in foot-candles for specific work. For instance, a bedroom is comfortably illuminated with a variation from ·2 to 1 foot-candle, but the dressing table and the part in front of the dressing mirrors must have at least 6 to 10 foot-candles on the dressing-table surface. A dining table requires not less than 2·5 foot-candles, and need not exceed 3·5; but the

ceiling and walls of that room should be kept from 5 to 1 foot-candle, so that the surroundings may be subdued in comparison with the table, and for this reason I do not advocate here indirect illumination.

Mr. Justus Eck, in a valuable paper on "Indirect Lighting," pointed out that animal life desired shade, and it is only when illumination for specific work is required that the brighter light is desired. While the billiard player likes a strong light on the table, he prefers a lower illumination for the rest of the room. I know of nothing more uncomfortable than a room equally illuminated on every square foot of the floor, and a room so lighted is, in my opinion, inartistic.

I suggest the following rules for illuminating the home :—

1. A room should not be evenly illuminated all over.
2. The filament of the lamp should be so placed as not to be in the line of vision under normal conditions.
3. The light should be so placed as to illuminate specific objects (according to the nature and purpose of the room).
4. Small units of light are in general to be preferred.
5. Indirect lighting should only be used for general lighting, or as supplementary to the necessary local illumination.

It is seldom that the engineer is allowed free scope in placing the lights as he, in his opinion, thinks best, and, in a word, it is more difficult to satisfy the taste of the owner than the actual requirements of the house.

The town house requires more light than the country house; the same people who consider a 16-C.P. lamp too strong in the country will complain that a 30-C.P. lamp is insufficient when in town. Excess of light in the town compels the same fault to be perpetrated in the home, and for this reason the hall and corridors should never be illuminated to a higher degree than the rooms. The effect would be to render the remainder of the lights insufficient by contrast. I have known a number of cases where the illumination of the house generally was considered satisfactory until a metal-filament lamp had been fixed in the hall, doubling the original candle-power and causing dissatisfaction with the rest of the lighting (which until then was considered ample). It is, therefore, important that in no case should any excess of light be provided in the less important positions in the house, such as the corridors, &c

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Combination Electric Fan.

DURING the hot weather most contractors are faced with the unpleasant necessity of stocking several patterns of electric fans, the demand covering "porthole" fans, ceiling fans, table fans, fans to fix on walls, &c.

The new "Union Interchangeable" fan motor has been specially designed by the UNION ELECTRIC CO., LTD., of Park Street, South-

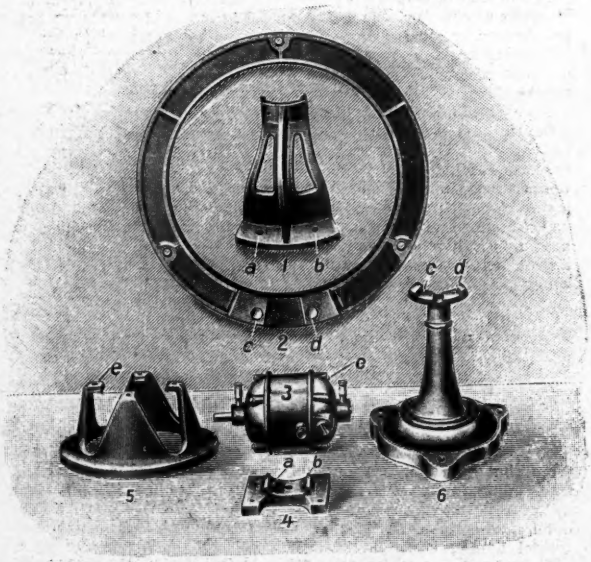


FIG. 1.—THE UNION INTERCHANGEABLE FAN PARTS—SEVEN COMBINATIONS

wark, S.E., to cope with this problem. Briefly, the scheme is as follows (fig. 1):—

The small motor (Part 3) is in itself complete as a moving agent. Mounted on the small base (4), and provided with a pulley, it becomes the familiar motor for light driving work; fixed to the pedestal (6), and fitted with blades and guard, it becomes the standard table fan; attached to the cylindrical stand (5), and provided with blades, it is converted to a vertical-spindle fan, which may be used in its normal position as an exhaust fan, or, inverted, as a ceiling fan. It may be mounted on a bracket (1), and used with blades as a wall fan; or, by again mounting the bracket on the ring (2), it becomes the well-known "porthole" fan. It is obvious that any combination can be sold as a complete article, when it is only necessary to replace the parts thus disposed of.

The motors are made for alternating or direct current in a large range of sizes, and to run on all standard voltages; and all motors of the same output, for any speed or voltage, D.C. or A.C., are interchangeable with the fittings for that output. The design is such as to produce a motor of very small weight for output. The workmanship and finish throughout are of high quality, and the little machines operate smoothly, silently and without overheating. The windings have been specially designed to withstand olimatic variations, particularly those of tropical countries.

B.T.-H. Fan Motors.

The accompanying illustration shows the latest pattern of oscillating electric fan introduced by the BRITISH THOMSON-HOUSTON CO., LTD., of Rugby. The motor has a four-point regulating switch in the base, giving three running speeds, and the yoke is hinged to the base so that the same fan can be used either as a desk or a wall-bracket fan. The oscillating mechanism is contained in the small gear case shown on the back of the motor; the

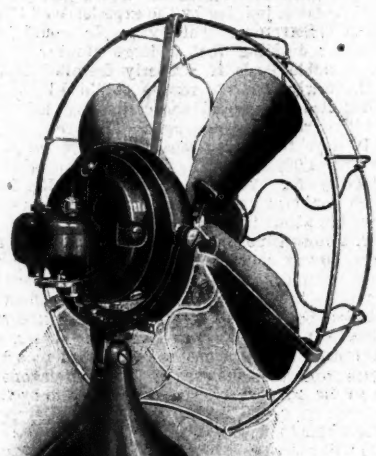


FIG. 2.—B.T.-H. OSCILLATING ELECTRIC FAN, D.C. DESK AND WALL-BRACKET TYPE.

connecting rod can be adjusted for three angles of operation, and a handle on the top of the gear case controls the mechanism, which can be put in and out of gear whilst the motor is running. The guard is strongly made, so that it can be used for handling the motor without risk of injury. The motor illustrated is for direct-current; similar A.C. sets are made, as well as a variety of other patterns, in two sizes, and are described in a list recently issued by the company.

Household Reflector.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., are now placing

FIG. 3.—NEW HOLOPHANE SHADE.

on the market a new type of Holophane household reflector, No. S.F. 8054, which is shown in the accompanying illustration.

Lamp Remover.

THE DAVIS ELECTRICAL CO., LTD., of 17, Moor Street, W., have introduced a simple, but effective, instrument for removing and replacing lamps otherwise inaccessible, except with the aid of a ladder. As shown in fig. 4, it consists of a set of spring fingers mounted on the end of a long cane, and provided with a pneumatic

india-rubber cushion, which, being pressed against the lamp bulb grips the latter, and enables the user to turn it in its socket so as to remove it from the holder. Similarly, a new lamp can be inserted with equal ease. The secret of success resides in the use of the rubber pad above-mentioned. To hold pendants firmly

Fig. 4.—Davis Lamp Remover.

against the pressure of the lamp remover, a second cane is provided, fitted with a device for this purpose, and as we have proved, it is an easy matter with these two tools to change lamps without fear of breaking them or the filaments.

Theatre Dimmer.

The accompanying illustration, fig. 5, shows a bank of "Adams Igranic" metallic dimmers having three rows, each row consisting of six plates. This apparatus is suitable for use on a 105-volt 83-cycle single-phase circuit, and each row is capable of controlling 142 32-c.p. tantalum lamps. Each dimmer plate has its individual operating handle, and there is also fitted an interlocking master

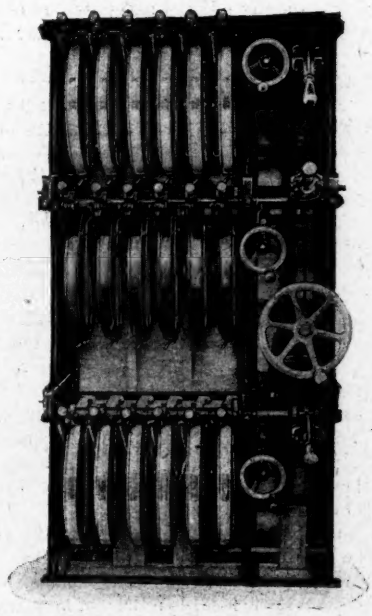


Fig. 5.—"Adams Igranic" Theatre Dimmer.

lever to control the whole row, a handwheel also being provided for slow motion. In addition, the whole bank is controlled by one master handwheel. Each operating handle has a label indicating what circuit is controlled by it. The dimmer was made by the Adams Manufacturing Co., Ltd., Bedford.

Henley Wiring System.

The wiring system introduced by Messrs. W. T. Henley's Telegraph Works Co., Ltd., at the electrical exhibition at Olympia last year, and then described in our pages, has met with a good reception from contractors, and has been widely adopted. A new patent fixing clip has now been brought out, of a very simple and neat design; it is illustrated in different stages of application in fig. 6. The clip is made of tinned brass, and may be fixed either with a nail or a countersunk screw. New bonding clamps and joint boxes of tinned brass have also been devised.

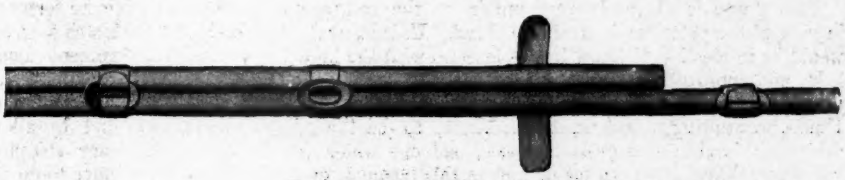


Fig. 6.—Henley's "Link" Cable Fixing Clip.

LEGAL.

West Ham Corporation *v.* Shiels.

Last week, before Mr. Gillespie, Robert J. Shiels, an electrician of Upton Lane, Forest Gate, was summoned by the West Ham Corporation for connecting electric wires with those of the West Ham Electric Supply, without the consent of the Corporation.

Mr. George E. Hilleary, for the Corporation, said (according to the report in the *Morning Advertiser*) that a tradesman in Forest Gate, on April 10th, applied for the supply of electrical energy, and the defendant was named as the contractor who was to install it. The names of two references were given, but letters sent to them were not replied to, and the connection was consequently delayed. The Corporation intimated that they would supply electricity if a deposit of 10s. was paid, but the tradesman refused to pay the money, and the next day Mr. Shiels rang up on the telephone, saying that he was going to connect. He was told that he must not do so, but he did connect, and current was consumed though no meter was used.

Mr. J. W. Richards, for the defendant, admitted the facts. He said that the West Ham Corporation in their electrical department were a trading concern, and as such were rivals of the defendant in business; and the manner in which the Corporation acted was gradually squeezing out of business small electrical contractors. In this instance they were rival tenderers for this installation, and Mr. Shiels thought that as he had secured the contract, the Corporation were purposely withholding their consent to connect. Mr. Shiels's client had come to an end with his gas contract, and on April 16th—after a lapse of a week—he did connect with the Corporation wires; but he disconnected next morning, and the utmost value of the current used could only have been about a penny.

Mr. Hilleary stated that the defendant had on two other occasions connected in the same way, and that was really the reason for these proceedings.

Mr. Gillespie pointed out that the defendant gave notice of what he was going to do, and in the circumstances he would only fine him 20s. and costs.

The Electric and Ordnance Accessories Co., Ltd., *v.* Handcock.

An action and counterclaim by the Electric and Ordnance Accessories Co., Ltd., *v.* Handcock, were down for hearing by Mr. Justice Warrington, in the Chancery Division, on Tuesday. Counsel for the plaintiffs asked his Lordship for an order by consent upon terms agreed between the parties, giving judgment for the plaintiffs on the claim for £200, payable by 100 monthly instalments of £2 each, the first to be made on August 1st, 1912, and, in default of any instalment, the whole balance remaining unpaid to become payable forthwith; and also giving judgment for the plaintiffs on the counterclaim, each party to bear their own costs.

His Lordship made the order agreed upon

South-Eastern Railway Co. and The South-Eastern and Chatham Railway Co.'s Managing Committee *v.* The London Electric Railway Co.

A motion in this action was down for hearing before Mr. Justice Parker in the Chancery Division on Tuesday, but counsel holding a brief for Mr. Percy Wheeler, who represented the plaintiffs, said that the parties were in negotiation, and there was every probability that minutes of an order would be signed. Under those circumstances he asked that the motion might stand over generally, with liberty to restore it on two days' notice.

His Lordship assented.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

An Objectionable Clause.

In a specification for electric lighting which has just been issued on behalf of the Poplar Guardians, the following extraordinary clause appears, following the usual stipulations as to payment of Trade Union rates and observance of Trade Union conditions :—

"The contractor shall accept and recognise the Union in the trade affected as the sole arbitrator in any question arising under this clause."

This clause is obviously very unfair to the contractor in view of the notorious bias of the Trade Unions, and it would be interesting to know if it is inserted with the knowledge and approval of the Local Government Board. The principle of admitting one party to a dispute, whether Trade Union, consulting engineer, or architect, to be the sole arbitrator is clearly a gross injustice, and one which you yourselves have often criticised. If, in this instance, every tenderer expressly excepts the objectionable clause from his tender, the Guardians will be obliged to drop what is, to put it mildly, an audacious attempt to extend the powers of the already too powerful Trade Unions.

Fairplay.

A Minimum Wage for Electrical Engineers.

Reading my papers the other morning, I noticed an insertion from a Penang newspaper deploring the loss of "British prestige" in the engineering world, and attributing this to the degeneracy of the brain department more than the workmen. The word engineering, of course, covers a very wide circle, including, as it does, civil, mechanical, marine and electrical, but from the latter's point of view the article was more than right, and the fact should be studied seriously by those in authority.

Surely the powers that be are aware of the gigantic future before electrical engineering, and recognise the necessity of encouraging and keeping brains in this trade, to meet the demand and incidentally to cope successfully with the foreign competition which, even at the present day, is swamping our markets.

Having noticed the evil, it behoves us to discover its cause, and if possible apply a remedy. The object of this letter is to point out one cause which is apparent to all those who take the trouble to think. In a recent issue of the ELECTRICAL REVIEW was an advertisement inquiring for an improver, with technical training, who would give his services for 12s. per week. This means that a young fellow who has just finished his apprenticeship, for which he probably paid £200 to £300, and one who has spent his evenings studiously at a technical school, is of less worth to the community than a crossing-sweeper or a dustman.

The matter is (if I may use the expression) cynically humorous, but it is the state of affairs that greets the unfortunate apprentice on completion of his time.

How many cases are there of smart young electricians who, finding it an impossibility to get a situation at an adequate—and I might add living—wage, have thrown up their profession and embraced another, automobile engineering, for instance? I personally know of three, one of whom patented a very useful invention while serving his time, and there, you see, is a case of brains of proved worth being lost to a trade in England whose very existence depends upon her keeping up with the steady improvement of other nations.

My own experience will show precisely how matters are at the present day. I put in for an increase of salary, but the managing director of my firm politely told me he could get a bachelor of science for £3 a week, and that it was Mr. X (a commercial traveller with a large connection) who was worth his money to the firm. Yes, quite so; but, with all respect to Mr. X and his undoubted powers of oration, where would he be if he had nothing of worth to talk about? All the speeches in the world would not sell a dynamo made by a firm with a reputation for indifferent design, and that is exactly the comparison that will shortly exist between Great Britain and foreign countries, simply because men with brains are forsaking the profession every day because it is not made worth their while to stay, and I wish I could live long enough to see the happy position of the "board of directors" who are responsible for the decline of British electrical engineering.

Having decided that the cause is due to the inadequate wage, and the opinion evidently held in some quarters that the electrical profession is taken up more as a hobby than a means of livelihood, I must speak about a remedy; but here a gigantic reform is necessary, and could be dealt with much better by wiser heads than mine, though one point seems obvious, that is, the Government should pass a minimum wage bill which would not only encourage those in the trade, but would enable the poorer man to work on a level with his more fortunate competitor who does not depend on his profession as a means of livelihood.

The Government ought to recognise that electrical machinery is rapidly replacing other kinds, and will, it does now in fact, command a great share in the world's imports and exports, and by allowing foreigners to forge ahead, we are injuring our shipping, and incidentally lots of other trades which have to do with electrical engineering.

P. Booker, Stud.I.E.E.

Richmond, *May 29th*, 1912.

The Engineer and the Clerk.

Referring to your recent article on "The Engineer and the Clerk," as a member of the clerical staff, and in a responsible position of a large supply undertaking, the question of subordination need not be considered in the least, each department being equally necessary to the welfare of the concern, and I can assure Mr. Goody that the duties are not only "the subsidiary and somewhat menial one of keeping records of work done and money spent," there also being, besides "sticking on of stamps and copying letters," the rather important one of money received, upon which the salaries of the engineers, and also the clerical staff, depend; and, again, the satisfying of consumers when making complaints—a very necessary adjunct to the welfare of an undertaking—usually depends upon the tact of the members of the office.

Referring to the pitifully small salaries received by clerks, Mr. Goody would do well to refer to the vacancies' list published in your paper weekly. Charge engineers at £80 per annum, rising to £100 per annum, and shift engineers at 30s. per week, &c. How munificent! At the same time, it would be interesting to know how many engineers are kept in comfortable positions by trading on the superior knowledge of their subordinates, getting this mere pittance. I can tell him of some. It might also interest him to know that there are many clerks whose education has cost more, whose wit and skill is keener, and are equally as, if not more, intellectual than the skilled (?) mechanic, but, owing to force of circumstances, have been compelled to earn their living at an early age.

The explanation of the junior clerk being referred to as "Mr. So-and-so," and the meter superintendent as "So-and-so," is the regrettable fact that many engineers, although they may be well educated, lack the ordinary manners and civility of everyday life.

A clerk is appointed to a position with the idea of his learning the entire business from a management point of view, and throwing his whole energies into its welfare, perhaps for the rest of his life; the engineer, on the other hand, is a migratory sort of bird and is frequently on the move, showing that his own interests are more to him than those of his employer, and the sooner the engineers and clerks realise that it is their duty to interest themselves in the commercial and engineering sides of their business, the sooner shall we arrive at "Utopia," but so long as this agitative form of class hatred is taken up, which is so derogatory, so long will it be detrimental to the furtherance of the use of electricity.

In thanking Mr. Goody for this opportunity of expressing myself, I should like to point out that either as engineers,

clerks or labourers, we are only spokes of the same wheel, and if my employers again require technical services from me, as they have done in the past, I am prepared to undertake them, no matter whether I am called "Mr." or "Bill."

P. H.

RATING OF CABLES.

By J. WAGNER.

The I.E.E. wiring rules of April, 1911, contained new ratings for V.I.R. and paper-insulated cables, based upon tests carried out in the National Physical Laboratory. The report rendered by Messrs. S. M. Melsom and H. C. Booth before the Institution of Electrical Engineers (see *Journal* I.E.E., May 21st, 1911) forms a very fruitful source for further investigation, and will be highly appreciated by all those interested in the question. It has already been pointed out, however, that the conditions of laying cables in practice differ somewhat from those under test, and no notice was taken of these differences in framing the new rules.

It will, therefore, be of some interest to compare the new rules with others most extensively used on the Continent, the German rules of the V.D.E. (German Association of Electrical Engineers). Table I printed below shows the ratings according to the new I.E.E. rules side by side with the German ratings.

When comparing the German with the English ratings, it must be borne in mind that the English values are based upon different temperature rises. But it will be noted that the German rules meet the demand for more closely specified ratings to a greater extent than do the new English rules. Both are, however, still unsatisfactory.

To recognise how far they still fall short of everyday practical necessities, one need only review the different kinds of insulation in general use and the different methods of cable laying which are employed for different conditions, both of which have great influence on the temperature rise. The different kinds of insulation in use are :—

1. Vulcanised india-rubber insulation, with or without armouring.
2. Bitumen insulation, with or without armouring.
3. Paper or fibre insulation, leadless, with or without armouring.
4. Paper or fibre insulation, lead-covered, with or without armouring.

The most common ways of laying cables are the following :—

1. In wood casing.
2. In iron conduit, on or underneath the plaster.
3. On insulators (cleat or cable racks) on walls, in trenches or in earthenware troughing.
4. In wood troughing, bitumen filled.
5. Laid direct in the ground 25 to 30 in. deep.

The influence that the construction and laying of a cable have on its temperature rise for a given load is certainly not to be under-estimated, and while cables rated in accordance with the new rules will be perfectly safe under normal conditions, they will sometimes rise much more than 11·1° C. or 27·7° C. respectively. The economical, as well as the technical considerations, seem to justify the attempt to define more closely the carrying capacities of cables with a predetermined temperature rise dependent upon the construction and method of laying.

As the temperature rise increases for a given cable approximately as the square of the current, it is thought sufficient for practical purposes to compile tables for a temperature rise, such as would be convenient and practical in normal cases. On these conditions the following tables have been based. Table II is for vulcanised india-rubber and bitumen-insulated cable at 15° C. temperature rise, and Table III for paper or fibre-insulated cables at 25° C. temperature rise. For tropical climates, or especially hot rooms such as boiler houses, it seems advisable to take 80 to 85 per cent. of the values quoted for V.I.R. and bitumen, and 80 to 90 per cent. of those quoted for paper cables.

The tables cover the crowding of cables in conduit up to four cables per conduit. Beyond that it will be easy to

TABLE I.

Section per core.			Maximum amperes. Continuous load.											
			German V.D.E.	English I.E.E.	German V.D.E. (underground).									
Description.	mm².	Square inches.	V.I.R. insulation. Rise.		Paper or fibre insulation (21° C. rise; V.D.E.)									
			20° C.	11·1° C.	— 27·7° C.	1-Core. 700 v.	2-Core. 3,000 v.	2-Core. 10,000 v.	3-Core. 3,000 v.	3-Core. 10,000 v.	4-Core. 3,000 v.	4-Core. 10,000 v.	Concentric 3,000 v. Double.	Concentric 3,000 v. Triple.
3/22	1·16	0·0018	11·8	7·2	7·2	28·4	...	...	...	...	...	...	...	...
3/21	1·55	0·0024	14·5	9·5	9·5	32	...	...	...	...	...	...	...	...
3/20	1·93	0·0030	12·0	12	12	37·5	...	...	...	...	...	...	...	...
3/19	2·4	0·0037	19·0	14·8	17·8	39·5	...	...	...	...	...	...	...	...
7/22	2·7	0·0042	21	17	17	44	...	...	...	...	...	...	...	...
3/18	3·4	0·0053	23	20	21·2	50	...	...	...	...	...	...	...	...
7/20	4·5	0·0070	27	24	28	60	46	...	40	...	37	...	...	...
7/19	5·6	0·0086	30	28	34·6	65	50	...	45	...	40	...	...	...
7/18	8·0	0·0125	37	34	50	83	62	...	57	...	50	...	...	...
7/17	11·0	0·017	47	40	65	105	75	69	69	65	62	60	76	60
7/16	14·2	0·022	67	46	75	116	85	80	75	71	69	64	85	70
7/15	18·1	0·028	79	53	86	133	98	90	88	83	79	74	95	79
19/18	22	0·034	90	59	96	150	110	100	97	92	88	83	105	88
19/16	38·7	0·060	135	83	135	225	160	150	145	135	130	125	155	130
19/14	60·6	0·094	180	113	183	290	210	195	185	175	170	155	200	170
19/0·083	64·5	0·100	190	118	191	305	220	205	195	185	180	165	210	180
37/16	75	0·117	210	130	210	340	245	230	210	200	195	180	230	195
19/13	81	0·125	230	134	219	360	260	240	220	210	210	195	250	210
37/15	97	0·150	245	152	246	390	280	260	245	230	225	210	275	225
37/14	117	0·182	275	172	275	440	310	285	275	255	245	230	300	250
37/0·083"	129	0·200	295	184	296	475	335	305	295	275	265	255	330	270
37/13	161	0·250	350	214	343	550	390	360	340	320	310	295	390	310
37/12	194	0·300	400	240	385	600	425	400	350	353	345	325	425	345
37/0·112"	225	0·350	425	264	425	635	450	...	400	...	370	...	450	370
61/13	259	0·40	480	288	464	710	500	...	450	...	410	...	500	410
61/0·097"	290	0·45	510	310	502	740	525	...	470	...	430	...	525	435
61/0·104"	322	0·50	550	332	540	800	560	...	500	...	455	...	560	465
61/0·108"	355	0·55	590	357	583	850	590	...	530	...	...	...	600	490
61/0·112"	387	0·60	615	384	624	850	610	...	550	...	...	...	620	510
61/0·118"	420	0·65	650	410	662	920	...	...	...	...	...	...	...	...
91/0·098"	450	0·70	700	434	700	960	...	...	...	...	...	...	...	...
91/0·101"	484	0·75	740	461	738	1,000	...	...	...	...	...	...	...	...
91/0·108"	515	0·8	780	488	776	1,050	...	...	...	...	...	...	...	...
91/0·112"	580	0·9	840	540	854	1,150	...	...	...	...	...	...	...	...
91/0·118"	645	1·0	900	595	932	1,225	...	...	...	...	...	...	...	...

TABLE II.—Vulcanised India-rubber and Bitumen Insulated Cables.

Section per core.			Maximum amperes continuous load for air = 30° C.; rise, 15° C.									
			Single core up to 650 volts.					Single and multicore up to 3,000 volts.				
				Laid in conduit.				Armoured laid underground or unarmoured in air.				
Description.	mm².	Square inches.	Wood casing or bitumen-filled troughs.	Wires per conduit. 1	2	3	4	1-Core.	2-Core.	3-Core.	4-Core.	Concentric. Double.	Triple.
3/22	1·16	·0018	7·5	8·5	8·5	8·5	8	8·5	...	...	...	...	...
3/21	1·55	·0024	10	11	11	11	10	11	...	...	...	...	...
3/20	1·93	·0030	13	14	14	14	13	14	...	...	...	...	...
3/19	2·4	·0037	15	16·5	16·5	16	15	17	...	...	...	...	...
7/22	2·7	·0042	18	18·5	18	17·5	17	19	...	...	...	...	...
3/18	3·4	·0053	22	22	21	20	19	22	...	...	...	...	...
7/20	4·5	·0070	26	26·5	26	25·5	25	26·5	22	19	16	...	...
7/19	5·6	·0086	30	30·5	30	29·5	29	30·5	25	21·5	18	...	...
7/18	8·0	·0125	37	37·5	37	36·5	36	38	32	27·5	22·5	...	...
7/17	11·0	·017	42	44	42	40	39	48	41	35	28·5	38	28
7/16	14·2	·022	47	51	47	45	42	56	48	41	34·5	46	35
7/15	18·1	·028	56	58	56	50	45	64	55	47	39·5	55	47
19/18	22·0	·034	60	67	63	60	55	71	60	51	43	60	51
19/16	38·7	·060	85	98	90	85	80	103	85	71	62	85	71
19/14	60·6	·094	113	130	120	113	110	135	105	93	83	105	90
19/·083"	64·5	·10	118	134	125	118	112	145	111	99	88	111	95
37/16	75	·117	130	148	...	...	...	155	120	105	95	120	102
19/13	81	·125	134	157	...	...	...	165	130	112	101	130	110
37/15	97	·150	152	170	...	...	...	180	143	122	112	143	120
37/14	117	·182	172	193	...	...	...	205	160	139	128	160	135
37/·083"	129	·20	184	208	...	...	...	220	170	150	140	170	145
37/13	161	·25	214	235	...	...	...	250	195	175	165	195	165
37/12	194	·30	240	255	...	...	...	270	215	195	175	215	185
37/·112"	225	·35	264	283	...	...	...	300	240	210	195	240	205
61/13	259	·40	288	320	...	...	...	340	275	240	215	275	230
61/·097"	290	·45	310	340	...	...	...	360	295	250	230	295	240
61/·104"	322	·50	332	365	...	...	...	390	310	275	250	310	265
61/·108"	355	·55	357	400	...	...	...	425	340	300	...	340	290
61/·112"	387	·60	384	440	...	...	...	465	375	325	...	375	310
61/·118"	420	·65	410	470	...	...	...	500	...	...	...	...	...
91/·098"	450	·70	434	505	...	...	...	535	...	...	...	...	...
91/·101"	484	·75	461	540	...	...	...	570	...	...	...	...	...
91/·108"	515	·80	488	570	...	...	...	605	...	...	...	...	...
91/·112"	580	·90	540	635	...	...	...	675	...	...	...	...	...
91/·118"	645	1·00	595	710	...	...	...	750	...	...	...	...	...

TABLE III.—Paper-Insulated Leadless and Lead-Covered Cables.

Section per core.			Maximum amperes continuous load for air = 30° C.; rise, 25° C.															
			Paper insulated, lead covered, and armoured, laid underground in trenches from 25 in. to 30 in. deep.										Leadless armoured and paper lead covered.				Underground or on insulators or in troughing.	
			Up to 3,000 volts.						From 3,000—10,000 volts.				Up to 3,000 volts.					
			Number of cores.				Concentric.		Number of cores.				Number of cores.				Concentric.	
Description.	mm.²	Square inches.	1	2	3	4	2	3	1	2	3	4	1	2	3	4	2	3
7/20	4·5	·0070	53	46	40	37	...	...	...	...	...	...	36	30	26	24	...	...
7/19	5·6	·0086	58	50	45	40	...	...	...	...	...	...	45	37	33	30	...	...
7/18	8·0	·0125	72	62	57	50	...	...	...	...	...	...	55	47	43	39	...	...
7/17	11·0	·0170	86	75	69	62	76	60	80	69	65	60	65	57	52	47	57	47
7/16	14·2	·022	98	85	75	69	85	70	92	80	71	64	75	65	57	52	65	52
7/15	18·1	·028	112	98	88	79	95	79	104	90	83	74	90	78	70	63	78	63
19/18	22·0	·034	125	110	97	88	105	88	115	100	92	83	100	86	76	69	86	69
19/16	38·7	·060	185	160	145	130	155	130	175	150	135	125	140	122	110	100	122	100
19/14	60·6	·094	243	210	185	170	200	170	225	195	175	155	185	160	140	125	160	125
19/·083"	64·5	·10	255	220	195	178	210	178	237	205	183	162	195	168	145	130	168	130
37/16	75	·117	290	245	210	195	230	195	270	230	200	180	215	183	155	140	183	140
19/13	81	·125	305	260	220	210	250	210	285	240	210	195	230	195	165	150	195	150
37/15	97	·150	330	280	245	225	275	225	310	260	230	210	260	220	190	170	220	170
37/14	117	·182	365	310	275	245	300	245	340	285	255	230	300	255	225	205	255	205
37/·083"	129	·20	400	335	295	265	330	265	370	305	275	255	315	265	235	215	265	215
37/13	161	·25	460	390	340	310	390	310	430	360	320	295	365	310	270	240	310	240
37/12	194	·30	500	425	380	345	425	345	470	400	355	325	400	340	305	275	340	275
37/·112"	225	·35	530	450	400	370	450	370	...	...	...	...	450	380	338	300	380	300
61/13	259	·40	585	500	450	410	500	410	...	...	...	...	500	425	380	340	425	340
61/·097"	290	·45	615	525	470	430	525	435	...	...	...	...	540	460	410	370	460	370
61/·104"	322	·50	660	560	500	455	560	465	...	...	...	...	578	490	435	395	490	395
61/·108"	355	·55	700	590	530	...	600	490	...	...	...	...	615	520	460	...	520	420
61/·112"	387	·60	720	610	550	...	620	510	...	...	...	...	650	560	490	...	560	450
61/·118"	420	·65	760	...	...	...	...	...	...	...	...	...	685	...	...	...	...	...
91/·098"	450	·70	800	...	...	...	...	...	...	...	...	...	720	...	...	...	...	...
91/·101"	484	·75	840	...	...	...	...	...	...	...	...	...	755	...	...	...	...	...
91/·108"	515	·80	880	...	...	...	...	...	...	...	...	...	790	...	...	...	...	...
91/·112"	580	·90	960	...	...	...	...	...	...	...	...	...	860	...	...	...	...	...
91/·118"	645	1·00	1,040	...	...	...	...	...	...	...	...	...	935	...	...	...	...	...

derive reliable figures by comparison. Cables in wood casing, when carried in separate grooves, may be considered as single. Cables crowded in trenches or on cable racks in troughs, may be rated by the following rule of thumb:—Let n = number of cables; q = section of each core. Then the current carried by one of these cables would have a value corresponding to a section—

$$q\sqrt{n}, \text{ divided by } \sqrt{n}.$$

As an example, consider six 0·1-sq. in. three-core V.I.R. cables mounted on cleats. Then the section will be—

$$0{\cdot}1\sqrt{6} = 0{\cdot}245.$$

From Table II it will be seen that the current corresponding to this section (·245) is 172 amperes. The

current each cable will carry must therefore be $172/\sqrt{6} = 70$, while it will be seen from the same table that one three-core cable of 0·1 sq. in. will carry, with the same temperature rise, 99 amperes. If three cables were laid instead of six, the carrying capacity would be found in the same way to be 76 amperes.

This rule of thumb takes more into account the section of cables to be dealt with than does the German rule, which states that "if more than two cables are in one trench, the rating should be reduced to 75 per cent. of those tabulated in Table I." Examples calculated by the above rule of thumb show that the reduction in carrying capacity is much greater for a number of heavy section cables than for the same number of light section cables crowded together, and these results agree with those found in actual practice.

BUSINESS NOTES.

Book Notices.—*Lektrik Lighting Connections.* By W. Perren Maycock. London: A. P. Lundberg & Sons. Price 6d.—This is a booklet briefly describing the numerous methods of switching which have been worked out by the publishers in connection with their well-known manufactures. The author lays stress on the practical importance of the subject and the great advantages to be derived from the intelligent arrangement of switch circuits, and besides explaining nearly 70 methods of switching, some of which have not previously been published, he includes some useful notes on illumination and switching in general. The book should be very useful to contractors, wiremen and others interested in the installation of electric light.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXI, No. 5. May, 1912. New York: The Institute. Price $1.

"*Journal* of the Western Society of Engineers." Vol. XVII, No. 3. March, 1912. Chicago: The Society. Price 50 cents.

"The College Quarterly." No. 9. March, 1912. Melbourne: The Working Men's College. Price 6d.

"Royal Commission on Mines Report, New Zealand." 1912. Wellington: Government Printer.

"Methods of Analysing Coal and Coke." By F. M. Stanton and A. C. Fielder. "The Use of Mice and Birds for Detecting Carbon Monoxide after Mine Fires and Explosions." By G. A. Burrell. "Liquefied Products from Natural Gas." By I. C. Allen and G. A. Burrell. "Alaskan Coal Problems." By W. L. Fisher. "The Use of Permissible Explosives." By J. J. Rutledge and C. Hall. "Steaming Tests of Coals and Related Investigations." By L. P. Breckenridge, H. Kneisinger and W. T. Ray. 1912. Washington: Government Printing Office.

"Railway Ready Reckoner." By Charles L. Harbert. 1912. Edinburgh: The Scottish Railway Traders' Association, Ltd. Price 2s. 6d. net.

"Fuel Economy." By W. H. Booth. London: S. Rentell & Co. Price 1s. net.

Quarterly Bulletin and *Annuary* of the American Institute of Architects. January, 1912. Washington: The Octagon.

"L'Electricité à l'Exposition de Bruxelles de 1910." By J. A. Montpellier. 1912. Paris: Dunod & Pinat. Price 15 fr.

"Science Abstracts." Vol. XV, Part 5. May 25th, 1912. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

We have received from the *Australian Mining Standard and Electrical Record* of Sydney and Melbourne a copy of the new edition of their classified Directory of firms supplying mining, electrical and industrial machinery, and everything for the mine.

Electric Clocks.—THE SILENT ELECTRIC CLOCK CO., of Goswell Road, E.C., have secured the order for the turret clock to be erected on the Hovis Co.'s new buildings. This clock will have four dials, each 9 ft. 6 in. diameter, and will be automatically synchronised to Greenwich mean time. Other orders placed with the Silent Co. are for clocks for post office use in Newfoundland and New Zealand, and for Government Buildings in Canada and in this country.

Private Meeting.—S. BOTTONE & SON, LTD., electrical engineers, Manor Road, Wallington, Surrey.—Pursuant to the provisions of the Companies' (Consolidation) Act, a meeting of the creditors of the above was held on May 29th, at the offices of Mr. H. A. G. Lewis, Temple Chambers, Temple Avenue, E.C., the liquidator of the company. According to the statement presented by Mr. Lewis, the liabilities to unsecured creditors amounted to £186. As a going concern the assets were estimated to realise £192, from which had to be deducted £11 for preferential claims. Just prior to the liquidation, certain machinery was removed from the premises, but it was stated that the machinery belonged to a relative of one of the directors, and had been let to the company for a small sum weekly. Proceedings were instituted against the company, and to prevent an execution being levied upon the machinery in question it was removed. The company was registered in October, 1910, with a capital of £2,000, divided into shares of the face value of £1 each. The company was formed to take over a business carried on by Mr. A. Bottone. The purchase price paid by the company was £364, of which £314 was discharged by the issue of fully-paid shares, and the balance of £50 was paid in cash. No resolutions were passed, and the voluntary liquidation of the company will, therefore, be continued by Mr. Lewis. The latter explained that he had authorised a sale of the stock in trade and plant by auction.

Dissolutions and Liquidations.—DAVIS ELECTRICAL CO., LTD.—It is announced in the *London Gazette* that, by an order made by the High Court on May 14th, the following were appointed a Committee of Inspection to act with the Official Receiver as liquidator of this company:—Mr. J. W. Rook (Sloan Electrical Co., Ltd.), Mr. S. F. Pangbourne (Siemens Bros. Dynamo Works, Ltd.), Mr. Otto Loewi (Electrical Co., Ltd.), Mr. Gordon Low (James McDougall, Ltd.), and Mr. F. H. Nalder (Nalder Bros. & Thompson, Ltd.).

THE ELECTRIC CONVERSION SYNDICATE, LTD.—A meeting is called for July 5th to hear an account of the winding up from the liquidator, Mr. F. S. Salaman.

THE SUNBEAM LAMP CO., LTD., Newcastle-on-Tyne.—In another part of this issue we report the meeting of creditors of this company. The following are creditors:—

Elliott Bros.	£115	Newcastle Water Co.	£21
Cranmer & Cheshire	63	Newcastle Gas Co.	175
British Oxygen Co.	23	North-Eastern Railway Co.	39
Bastian Elec. Heating Synd.	30	Planchon Co.	381
British Traders' Association	60	Redheugh Colliery Co.	182
Bainville, A.	75	Pearson & Co.	32
Angus & Co.	39	Weightman & Co.	26
Electrical Review	26	Reyrolle, Ltd.	24
Finlay & Co.	39	Satchwell & Co.	113
Cookson & Co.	98	Robinson & Co.	28
Beall & Co.	24	Plutte & Co.	113
Berry, Skinner & Co.	56	Tucker, J. H., & Co.	141
Charles Joyner & Co., Ltd.	29	Vilright Works, Ltd	287
Clayton & Walsh	30	Sterling Telephone Co.	140
Griffiths Bros.	32	Wandsworth Elec. Mfg. Co.	150
Hollefreyne & Co.	53	Watson, Burton & Corder	78
Credenda Co.	140	Hope & Sugden	133
Engineering Arc Lamp Co.	66	Westinghouse Metal-Filament Lamp Co., Ltd. (Vienna)	176
Doig Bros.	77	Ward & Goldstone	202
County of Durham Elec. Co.	262	Walsall Hardware Mfg. Co.	25
Grevener & Co., Ltd.	444	Marsh & Son	41
Cable Accessories Co.	32	Turner & Parser	65
Armorduct Co.	508	Sutter & Co.	46
Beecroft & Wightman	95	Blake Manure & Chemical Co.	1,526
Ingledew & Sons	64	Merz, C. H.	493
Behrens, Ltd.	47	Kuhelmann & Co.	611
Gregory Bros.	27		
Armstrong, —	27	Westinghouse Metal Lamp Co. (Royalty)	357
Marshall & Son	69		

German Lamp Imports and Exports.—The imports to, and exports from, Germany of incandescent electric lamps during the past five years have been as follows:—

	Import value. Marks.	Export value. Marks.
1907	1,063,000	10,478,000
1908	1,081,000	20,082,000
1909	1,696,000	36,414,000
1910	1,110,000	49,520,000
1911	1,310,000	47,758,000

The countries which buy most lamps from Germany are the United Kingdom, Russia, Italy, France, Austria-Hungary and the Argentine, but unfortunately, although the weights figures of last year's export can be given, the official value figures are not yet obtainable. With this exception a comparison of the last three years gives the following table:—

	1911. Weight in double centners.	1910. Weight in double centners.	Value in marks.	1909. Weight in double centners.	Value in marks.
United Kingdom	3 192	5,596	13,989,000	4,448	9,786,000
Russia	2,579	2,133	5,332,000	1,990	4,378,000
Italy	1,499	1,177	2,942,000	740	1,628,000
France	1,372	1,543	3,857,000	1,488	3,274,000
Austria-Hungary	1,148	1,348	3,362,000	1,152	2,535,000
Argentine ...	761	1,168	2,919,000	658	1,448,000

Canadian Agency.—A Canadian correspondent who has for 12 years held a position as chief electrician to an undertaking in Canada (near Montreal) is willing to take up an agency for alternating-current machinery and for wires. British or other manufacturers interested are invited to write Coteau du Lac, c/o ELECTRICAL REVIEW offices.

The Electric Supply Publicity Committee.—The permanent offices of this Committee are now 20A, Tudor Street, Ludgate Circus, E.C.

Sale by Auction.—At Newcastle-on-Tyne on May 31st by order of the Receiver for the debenture-holders, Messrs. Wheatley Kirk, Price & Co., offered for sale by auction the extensive engineering works of Ernest Scott & Mountain, Ltd., at Gateshead-on-Tyne, as a going concern. Mr. H. Sherley-Price said the site was freehold, covering 6¼ acres, and the shops were level and served by railway sidings. The business was modern in design and equipment. The turnover had reached £100,000 a year, and even under the operations of the Receiver, who had not been prepared to take important contracts, it had been £20,000 a year. The property stood on the books of the firm at £120,000. Bidding commenced at £25,000, and advanced to £39,000, when the concern was withdrawn.

Church and Hotel Lighting.—The whole of the lamps and fittings for the lighting of the interior of St. James' Church, Streatham, which has recently been consecrated, were supplied by MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., and the contractors responsible for the actual work were MESSRS. DENNIS, ADAMS & CO., London, W. The church is illuminated with tantalum drawn-wire lamps, and the fittings were especially designed by Messrs. Siemens for the installation. Among recent hotel installations carried out by Messrs. Siemens is that at the Portman Hotel, where "Wotan" pure-drawn tungsten wire lamps are used throughout.

Bankruptcy Proceedings.—A. F. MANDER, electrical engineer, 258, Lozells Street, Aston, Birmingham.—Application for debtor's discharge is to be heard at Birmingham on June 20th.

CHARLES HENRY STEEL, electrical engineer, 1, Nelson Square, Bradford (late 53, Queen Street, Cardiff, and 65, High Street, Merthyr Tydfil).—The first meeting of creditors herein was held on May 30th at 117, St. Mary Street, Cardiff. The liabilities were estimated at £313, and there was an estimated deficiency of £172. It transpired that the debtor commenced trading in August, 1910, with £10 capital. He obtained the contracting work for exhibitions, on which he lost money. The debtor alleged that his failure was due to bad debts and losses on contracts. The Official Receiver remains trustee.

E. J. CROSIER (Crosier, Stephens & Co.), engineer and merchant, Newcastle-upon-Tyne.—The last day for receiving proofs for intended dividend is June 24th. Trustee: Mr. J. A. Gardner, 145, Pilgrim Street, Newcastle-on-Tyne.

For Sale.—The Postmaster-General has for sale a quantity of electrical plant and machinery at the Birmingham G.P.O. See our advertisement pages to-day.

Catalogues and Lists.—THE BRITISH PROMETHEUS CO., LTD., Salop Street Works, Birmingham.—Illustrated price cards relating to liquid heaters, electric irons and electric kettles respectively.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, London, E.C.—New list (No. 69) of 20 pages, giving full information and prices relating to the Henley wiring system, concentric and twin, and its various details, together with instructions for its installation. The accessories that are illustrated and priced include the "H.W.S." fitting, bonding clamps, wood blocks, the "Link" cable fixing clip, saddles, protective covering, joint and tee boxes, distribution fuseboards, transformers, and portable drums. The present list has been issued owing to the development of the system. Many additional sizes of cables are now listed, including a neat three-core cable of flat section, which will be useful in many instances. Copies of the list will be sent to any member of the trade not already supplied. Messrs. Henley's do no wiring work under any circumstances.

THE GENERAL ELECTRIC CO., LTD., inform us that they have organised a very extensive advertising campaign for popularising their well-known "Freezor" fans. One of the features of the campaign is the issue of two attractive advertisement folders, the covers of which are artistically printed in colours, whilst the contents set forth the various "Freezor" merits. These folders are for circularising direct to consumers, and the company are prepared to supply liberal quantities of same to the trade, specially printed with dealer's name and address.

MESSRS. SIMPLEX CONDUITS, LTD., London and Birmingham.—Abbreviated pocket fan list of eight pages, containing some revised prices, but not entirely superseding the 1910 general fan catalogue. Standard desk type fans, bracket type, porthole with propeller blades, are listed and shown, also the "Simplex" small motors from $\frac{1}{10}$ to $\frac{1}{2}$ H.P., sewing-machine motors, and starters for fans and small motors. The firm has introduced a new pattern low-priced 8-in. fan, consuming only 15 watts, which has bronze copper blades and a green painted body.

MESSRS. J. H. HEATHMAN & CO., Parsons Green, Fulham, London, S.W.—Leaflets relating to "Itiliti" folding platform steps and telescopic folding scaffold trestles.

THE INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., Silvertown, London, E.—Owing to alteration in the price of raw materials, the company has issued a 16-page revised price list (No. 27) relating to gutta-percha, india-rubber, silk and cotton-covered wires; also jointing tools and materials.

MESSRS. UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—12-page illustrated pamphlet (No. 15), containing a a full technical description of their polyphase motors (pattern HD), with endshield bearings.

THE BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, London, E.C.—Two illustrated leaflets relating respectively to aluminium overhead conductors, and to aluminium for rolling stock construction. The former shows the trunk lines (four circuits) of aluminium standard conductors crossing the Dundas Valley Ontario. These conductors are used on the whole 280 miles of the newly-erected lines of the Hydro-Electric Power Commission of Ontario.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, 77, Upper Thames Street, E.C.—New price list of British-made "Gem" lamps, giving a variety of information *re* standard packages, economy effected, as compared with ordinary carbon lamps, technical data, &c.

THE RECORD ELECTRICAL CO., LTD., Caxton House, Westminster, S.W.—Several illustrated and priced leaflets describing their automatic battery cut-in and cut-outs, and S.P. and D.P. overload circuit breakers.

THE WILSON-WOLF ENGINEERING CO., LTD., Thornton Road, Bradford.—Pocket price list of D.C. fans for the 1912 season. Arctic propeller type fans are priced, also speed regulators, spare parts, &c. Copies of the card can be obtained with or without the firm's name, on application.

THE ALLGEMEINE ELEKTRICITATS-GESELLSCHAFT, FOREIGN DEPARTMENT.—Pamphlets relating to electric crucible furnaces for laboratories and works, limiting device for electric brakes, and new overhead line materials. The A.E.G. Electrical Co., of South Africa, Ltd., Caxton House, S.W., have sent us a brochure (in English) giving very full illustrated information relating to the A.E.G. drawn-wire lamp; also a 40-page price list of three-phase, two-phase, and single-phase induction motors of from 7·5 to 100 H.P.

Trade Announcements.—MESSRS. SIMPLEX CONDUITS, LTD., announce that their telephone number "Central 15138" has been changed over to "City 6149," and the telephone numbers for the London Sales Department are now "City 6149 and 1875" and "Central 8101."

MR. H. FEATHERSTONE, electrical engineer and contractor, has opened premises at 41, Little Mount Sion, Tunbridge Wells.

MR. GEO. FISHER, electrical engineer, has opened new offices and showrooms at 23, St. Leonards Road, Bexhill-on-Sea.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., announce that, owing to increased business in electric lamps and supplies, they have taken premises to accommodate larger stocks of "Auriga" metal-filament lamps, electrical accessories and fittings, at 179, Wardour Street (off Oxford Street), London, W., where all communications in connection with their London supply business should henceforth be addressed.

THE FOSTER ENGINEERING CO., LTD., of Wimbledon, announce that they have secured the whole of the stock, patterns, &c., of the Beck Flame Lamp Co., Ltd., of Hayes, Middlesex, and that they possess the sole right to manufacture and sell "Beck" lamps, &c. Their works are fully equipped for carrying on the manufacture and further development of these lamps. They will keep a large stock of finished lamps, spare parts, and carbons.

The *Australian Mining Standard* states that the WESTERN ELECTRIC CO. (AUSTRALIA), LTD., has been registered in Sydney, with a capital of £20,000, in £5 shares, to acquire the Australian business of the London company of the same name. The directors are A. Williams and J. Clarke.

LIGHTING and POWER NOTES.

Argentina.—The electric light station at San Andrés de Giles is now finished. A trial run has taken place, with satisfactory results. Public lighting consists of 40 8-ampere arc lamps.

Work has commenced on the electric light station at Coronel Vidal (Province of Buenos Ayres). The concessionaire is Sr. F. Mora.—*Review of the River Plate.*

Baildon.—The U.D.C. has decided to apply for a prov. order for electricity supply.

Barrow.—The Mayor in submitting the annual report on the electricity department, recently, said that the gross profit showed an increase of £1,110, and the net profit £967. The total gross profit was £9,138, against £8,028, and the net profit £1,673, against £706. The units sold had increased from 1,249,163 to 1,404,322, which was equal to 12½ per cent., whilst the cost of units sold was reduced from 1·231d. to 1·143d. There had been a steady improvement in the last few years, which was very satisfactory, but, as he told them 12 months before, they could not expect to reduce the costs very much until they had a larger consumption of electricity. They had reduced the costs last year, but for the coming year they would probably have to pay more for coal, &c. In 1907 there was a loss of £791; in 1908 a loss of £383; in 1909 a profit of £249; in 1910 a profit of £706, and this was increased to £1,673. The profit would be placed to the reserve fund.

Brazil.—A new electric power company in San Paulo is the "Empreza Luz e Força Meridionale Paulista," formed to supply light and power to the towns of Faxina and Capao Bonito. The president of the company is Dr. Marcio Pereira Munhoz, and the vice-president is Victor Nothmann, jun.

Bridlington.—The electrical engineer to the Corporation has reported that there was a net profit on the year's working of £1,376, an increase of £369 on the previous year.

The T.C. has decided to supply current for heating and cooking at 2d. per unit for 200 units per quarter, and 1d per unit beyond.

The L.G.B. has sanctioned a loan of £1,500 for the extension of the condenser plant at the electricity works.

Brighouse.—A L.G.B. inquiry was held last week into the Corporation's application for sanction to the borrowing of £3,000 for electricity purposes.

Canada.—According to the *Financier*, consideration is being given to a scheme of co-operation between the Governments of Alberta and Saskatchewan, and the Canadian Pacific, Canadian Northern and Grand Trunk Pacific Railway Companies, with a view

to the supply of an adequate water and hydro-electric power service to towns in the two provinces. The project involves the diversion of the south arm of the Saskatchewan River, and it is expected that the cost will reach close on £4,000,000.

Christchurch.—The B. of G. has decided to have the workhouse lighted by electricity, and a supply of current will be taken from the Bournemouth and Poole Electricity Supply Co. on the following terms:—For the new infirmary, 4d. per unit, reduced to 3½d. when the whole of the workhouse premises are lighted; power and heating, 1½d. per unit. Mr. Thos. J. Digby, of London, has been appointed as consulting engineer for drafting and issuing the specification and for supervising the work, at 5 per cent. on the total cost, and out-of-pocket travelling expenses.

Continental Notes.—GERMANY.—It is intended to enclose the Bürgermoor, in the north of the Osnabrück district, with the view of industrially utilising the turf for generating electricity, and the running of a power house to be built there. A section of the moor will also be set apart for experiments in the economic cultivation of turf.—*Zeit. fur Elek u Masch.*

SPAIN.—For its sub-station lately erected in the Calle del Ampero at Madrid, the Co-operatira Electrica obtained from German works three groups of converters, of 1,000 H.P. each. The company has now acquired another site for a sub-station, in the Calle de Hermosilla, orders for the machinery equipment of which are about to be placed.—*Electron.*

HOLLAND.—It is proposed to erect an electric power station at Bergen-op-Zoom, North Brabant.

FRANCE.—La Société Hydro-Electrique has submitted a scheme to the municipal authorities of Bayonne (Basses Pyrenees) for the electric lighting of the town.

La Société des Ateliers de Constructions Electriques du Nord et de l'Est, of Jeumont, has an order in hand for 16 large electric cranes for the harbour authorities of Bordeaux.

The City of Meaux and the neighbouring districts are about to be adequately supplied with electricity, two companies being concerned in the matter. The Compagnie Générale d'Electricité is about to start working its new station in the city itself. On the other hand, the Société Omnium Français is actively engaged in constructing its Eastern Meaux system, with a view to supplying a number of communes.—*Revue pratique de l'Electricité.*

A Government inquiry is being held into the application of an electric company at Grenoble for an 80 years' lease of a feeder of the River Arc, with a view to the erection of a power station for the supply of electric current to the city of Grenoble, and the neighbouring townships of Bramans and Verney. The company also intends to use water from Lake Noir on the French side of Mont Cenis.—*Revue pratique de l'Electricité.*

Cornwall.—Both the St. Just U.D.C. and the West Penwith R.D.C. have granted permission for the Cornwall Electric Power Supply Co. to use overhead lines in the districts for the transmission of current.

Darwen.—Following successful negotiations with the Darwen Manufacturing Co. and Messrs. Harwood Bros. for electric power supply, an application has been received by the Corporation from Mr. Robert Entwistle for the supply of electricity for the same purpose to Norfolk Street Mill, and terms are being negotiated.

Derby.—The Electric Lighting Committee of the T.C. has recommended application for a prov. order extending the area for the supply of current, so as to include the parishes of Kedleston, Quarndon, Duffield, Allestree, Little Eaton, Spondon, Chellaston, and Mickleover.

Dundee.—The accounts of the Electricity Department, just issued, show that the net revenue from the sale of current for the past year amounted to £49,359, and from rents and feu duties to £7; after meeting working expenditure, the balance was applied as follows: Interest, £8,267; expense of loans, £353; property and income-tax, £211; sinking fund, £7,438; appropriation account, £10,338. The total units sold showed an increase of 620,731 on the total for the preceding year. The total estimated revenue for the current year is £48,707.

Eastbourne.—The Electricity Committee has deferred the consideration of a report by the electrical engineer as to the provision of new plant, and has given him instructions to inspect Diesel engines in use at other works, and submit a further report.

Exeter.—The annual report of the electrical engineer (Mr. H. D. Munro) shows a considerable advance in output during the year. The units sold totalled 1,479,696, an increase of 71,696 as compared with the previous 12 months. The number of consumers increased from 1,475 to 1,614; the motors from 148 to 175, an increase of 27, the total H.P. connected being now nearly 600. The reduction of the price for lighting, which came into force at the beginning of the year, affected the receipts by about £1,000, and the lower rate for traction by £65, but the increased output, especially for power supply, counteracted more than half this reduction. The reserve fund attained to nearly the statutory maximum of 10 per cent. on the whole of the capital expenditure of £111,000. Against the latter sinking fund amounting to nearly £40,000 has already been provided. The total receipts were £18,382, and the working expenses £9,999, which left a gross profit of £8,383.

Farnham.—A supply of current was available at Farnham for the first time on May 30th, when the current was switched on by Mr. E. H. Hart, a director of the Gas and Electricity Co., Ltd.

Farnworth.—The L.G.B. has granted the D.C. permission to borrow further sums for the electricity and destructor works.

Halifax.—A loan of £5,000 for prospective expenditure on new mains has been applied for by the T.C.

Hastings.—The annual report of the Corporation electricity department for the year ended March 31st last shows that the undertaking has now turned the corner. During the past year the sale of current realised £14,507, and in addition public lighting realised £5,311, making a total of £19,819. The total expenditure amounted to £9,491, and the gross profit carried to net revenue account £11,116. After allowing for interest, loans and sinking fund, &c., the net balance transferred to profit and loss appropriation account is £90. The quantity of electricity generated during the year was 1,033,055 units, and of this quantity 281,323 was sold for public lamps and 658,620 to private consumers. Thus the total quantity sold was 939,943. The total cost per unit sold works out at 2·17d

Haywards Heath (Sussex).—At a meeting of the U.D.C. on Monday, a letter was read from Mr. Prior, of Burgess Hill, asking if the Council would consider or support a scheme of electric supply for the town. Several members spoke strongly in favour of the proposal, and the matter was referred to the Works Committee for consideration.

Heywood.—On May 31st, Mr. H. R. Hooper, of the L.G.B., held an inquiry into an application of the Corporation for power to borrow £3,000 for the electricity department. The Inspector alluded to the deficit of £2,541, and said that under the Electric Lighting Acts the deficit must be cleared up each year. The Board, he thought, would require that balance to be wiped out before any further loans were sanctioned.

Keighley.—The application of the Corporation for sanction to borrow £6,576 and £1,660 for electricity purposes has been the subject of an inquiry by the L.G.B. The principal items of the proposed expenditure are:—Water tower (£1,100), motor-generator (£550), water-tube boiler (£1,660), services (£1,100), and D.C. and A.C. mains (£1,500). The inquiry was adjourned in order that particulars of excess expenditure may be furnished.

Littleborough.—The U.D.C. has reappointed Mr. Hawtayne as consulting electrical engineer, at a fee of 25 guineas, plus 3 per cent. on contracts under £50 and disbursements.

Liverpool.—The Corporation Electricity Committee has instructed the electrical engineer to arrange for the extension of the existing railway sidings at the Lister Drive power station and for the accumulation of a stock of slack on the adjacent area. This is one of the outcomes of the labour troubles of last summer.

London.—HAMMERSMITH.—It seems quite appropriate that the cinematograph should be used to advertise the advantages of electricity; indeed, the possibilities in this direction have been drawn attention to in our pages. We are glad to note that the B.C. has come to an agreement with the Shepherd's Bush Empire to use the theatre cinematograph screen for this purpose for 12 months, at the cost of 6s. per week; the example could be advantageously followed in numerous towns, particularly where the electricity authorities supply electricity to the theatres.

BERMONDSEY.—The B.C. decided on Tuesday to inquire whether the L.C.C. was prepared to lend it £18,401 for the extension of the electric undertaking. The loan was sanctioned by the L.G.B., after it had been refused by the L.C.C.

Loughborough.—An account of the successful working of the electricity undertaking was given by Alderman Bumpus at the meeting of the T.C. on Monday last. He stated that the undertaking showed a balance for the year of £2,476, an increase of £603 over the previous year, on the net revenue account. The profit of £2,476 for the first time enabled them to do more than pay their way.

New Zealand.—The Thames B.C. proposes to raise a loan for the introduction of electric lighting in the town. Mr. Frederick Black, of Wellington, is the consulting engineer in connection with the project.—*Commercial Intelligence.*

Nottingham.—Upon the annual report of the Electricity Committee being submitted, at a meeting of the City Council, Councillor Hunstsman referred to the "colourless character" of the document. The Committee, he said, had evidently not met the demands which existed. Sir John Turney (chairman of the Committee) pointed out that it was 19 years since the electricity plant was put down, and the Committee were advised by the best men they could find. If they had placed more of their earnings to a big reserve fund, they might have afforded to scrap a big lot of plant and have started on new lines, but since they had had the undertaking the Finance Committee had drawn £120,000 in alleviating the rates. If the Finance Committee cared to forego the £15,000 which was handed over this year to them, the price could be reduced a farthing a unit, but the matter was really not worth talking about. Of the sum paid for plant, £250,000 was still owing, and new plant would cost £150,000 or £200,000. That was not to be thought of in the present position of the finances of the city. Of the units which went out, 50 per cent. did so at 1½d. per unit. The demand was spasmodic, and they had practically few consumers. They could produce current at a cheaper rate if they had some big consumers. The report was adopted.

Penistone.—The R.D.C. has granted permission for the Yorkshire Electric Power Co. to lay underground mains at Cawthorne, and overhead lines from Tivy Dale to Banks Hall.

Salford.—The Committee has decided to enter into an agreement with Messrs. Hulse & Co., Ltd., for the supply of energy, subject to the company guaranteeing a minimum consumption of 50,000 units per quarter for all purposes at ·85d. per D.C. unit for the first 50,000 units per quarter, and ·75d. for all units over 50,000; when mixed A.C. and D.C. is supplied, the average price for A.C. is to be ·05d. per unit lower than for D.C. supply.

U.S.A.—The Lehigh Navigation Electric Co., of Philadelphia, which is erecting a power station to utilise the waste production from the Lehigh Coal Co.'s pits, has placed an order for three 10,000-K.V.A. 11,000-volt 25-cycle three-phase turbo units, exciter turbines, &c. The maximum outpnt contemplated is 100,000 KW., and it is expected to supply energy ultimately to Philadelphia, 80 miles distant.

Warrington.—The gross profit on the electricity department for the past year has been £7,709, and after paying contributions to sinking fund and loans, there is a net profit of £1,746, which has been retained in the appropriation account, bringing up the working balance to £3,078. The reserve amounts to £9,358 and the debt extinguished to date, to £27,000.

West Bromwich.—The profit of the Corporation's electricity works for the past year is reported at £2,853, an increase of £1,071 on the previous year. The Electricity Committee recommends that the profits be allocated as follows: £1,446 to depreciation fund account, £200 in aid of the general district rate, and £1,207 to be carried forward.

Wolstanton.—The Stoke-on-Trent T.C. intends applying for a prov. order for electric lighting in the district for the Wolstanton U.D.C. with whom an agreement has been drafted. In the meantime, a licence to supply current is to be applied for.

Worthing.—In a report to the T.C., the resident engineer states that the continued growth of the business of the electricity undertaking has necessitated a further sub-division of the distributing network and the provision of a new feeder cable to enable the electrical pressure to be maintained at the minimum prescribed in the provisional order. Since March, 1910, 228 new consumers have been connected to the distributing mains, and the number of units sold and the revenue derived from the private consumers has been increased respectively by 93,000 and £1,000. He accordingly recommends that a new feeder cable be laid at an estimated cost of £1,070, and also that additions be made to the switchboard at an estimated cost of £120, to accommodate two sets of future dynamo connections and four sets of feeder connections. A further sum of £1,615 is also asked for to cover the cost of house services, and another £880 for distributing mains, bringing the total additional outlay up to £3,770. Commenting on the provision for house services, Mr. Porter states that the number provided for (250) is greater than has been provided for at any one time previously, but seeing that 131 new services were connected during the last financial year, and that there is at present no falling off in the number of services applied for, he considers it necessary to make provision for a larger number in future. The Electricity Committee supports the proposal to apply for the additional loan.

York.—The Corporation proposes to extend the generating plant at the electricity works at an estimated cost of £9,700, and an inquiry has been held following the Council's application for sanction to borrow this sum. The extension is rendered necessary owing to the increased demand for light, power and tramway purposes.

The T.C. has been recommended to reduce the price of current for the tramways to a flat rate of 1½d. per unit as from October 1st next. The present sliding rate ranges from 1½d. to 2d. per unit.

It has also been recommended to instruct the electrical engineer to prepare a scheme for lighting Bishopthorpe Road along the tramway route by electricity.

A loan of £800 for motors for hiring purposes for two years has been applied for. The T.C. has received from the B. of T. an order enabling current to be supplied to premises at Fulford.

TRAMWAY and RAILWAY NOTES.

Accrington.—The town clerk reported to a meeting of the Electricity Committee last week, that he had received an intimation from the Haslingden T.C. terminating, by six months' notice, the existing agreement as to working its system of tramways and the generation of current for same.

Australia.—The Hawthorn (Vic.) Municipal Council is negotiating with Trackless Trolley, Ltd., with the intention of adopting the "Ceues-Stoll" system for the proposed railless traction routes in the town.—*Commercial Intelligence.*

Ayr.—After visiting Leeds and Bradford, the Special Sub-Committee recommends that the Hawkhill district be served by the railless traction system.

Belfast.—The universal penny fare will not come into force for another year at least, according to the decision of the Corporation, which met on Monday last. The financial experts reckoned that the acquisition of the Glengormely line would mean a loss for some time, and that the general system would not bear a reduction of the fare until the Glengormely line was paying its way.

Canada.—*Electric Traction Weekly* says that the electrification of the Rossland division of the Canadian Pacific Railway in British Columbia, is being pushed forward to determine the applicability of such a course under the heavy conditions to be encountered. The section to be electrified runs from Rossland to Castlegar Junction. The length of the Rossland division is 29·3 miles, which with sidings and yard trackage, mounts up to a total trackage of 43 miles. The motive power installation will consist of four 70 to 80-ton electric locomotives, power being obtained from the West Kootenay Power and Light Co. at probably 60,000 volts. This will be utilised through motor-generator sets in sub-stations located either at Trail or Smelter Junction. Systems using A.C. 6,600 volts and D.C. 2,400 volts are being proposed.

Continental Notes.—AUSTRIA.—The Cracow Tramways Co. has secured a preliminary concession for the construction and working of several new lines of electric tramways in the district surrounding the town of Cracow.

FRANCE.—Plans are being prepared in respect of projected electric tramways between Limeuil and Bonneitil; between Sevres and Ville d'Avray and between Marnes and Chesnay in the Seine-et-Oise department.

The T.C. of Chateauroux has approved of the proposal of a company to install an electric railless service of motor-'buses with overhead trolley.

PORTUGAL.—According to the *Times*, the Lisbon Electric Tramway employés and the men employed on the elevators in the hilly parts of the town have struck work, with a view to improved wages and labour conditions. The company has appealed to the Government for protection.

ITALY.—A contract has been signed between the president of the Provincial Deputation of Alessandria and the representatives of the Westinghouse Co., and of the firms of Draken and Alessi, whereby the former grants a three months' option for the construction of a group of provincial electric tramways which will complete the tramway and railway network of the province. With the help of subsidies from the Government, the province and the communes, the three companies will construct and work some 20 separate electric tramway lines of a total extent of 450 kilometres, allowing a return to the province of 4 per cent. of the receipts, exclusive of the subsidies. In the event of the utilisation of the waters of the Scriva and of the Orba, surveys of which are now being made on behalf of the province, preference will be given to the three companies under a parity of conditions, which will extend on similar terms to any future provincial electric tramway lines.—*L'Ingegneria Ferroviaria.*

A French Consular report says:—The Northern provinces, situated at the foot of the Alpine ranges, form the chief seat of the hydroelectric development, but the rocky ridge which splits the peninsula into two watersheds contains throughout its course stores of power. Thus Umbria may be considered at the present moment as the province possessing the richest reserves of power. The energy of natural and artificial cascades possessed by this region is roughly reckoned as equal to 10,000,000 H.P. On January 1st, 1910, the 4,132 motors placed at the service of industry and capable of supplying 238,377 H.P., were allocated as follows:—1,457 electric motors with 44,311 H.P.; 1,245 steam motors with 94,092 H.P.; 945 hydraulic motors with 67,876 H.P.; 465 gas motors with 31,943 H.P.; 20 petrol motors with 599 H.P. Compared with the foregoing year progress was most marked in Venetia, in the Marches, in the Abruzzi, and in Campania. On the other hand, noteworthy extensions were effected in the networks constructed in Piedmont, Lombardy Tuscany, and Latium. From the information available regarding 69 of the 86 generating stations sanctioned, it appears evident that water-power largely predominates, but it is also observed that gas is preferred to steam, and that there is a growing demand for heavy oil and petrol motors. Among the most remarkable installations effected in 1910 were:—(1) The line crossing the province of Chieti, Aquila, Campobasso and Caserta, ending within the precincts of Naples, after a course of 190 km. The pressure of this line (86,000 volts) is the highest existing in Italy up to the present time; (2) the line from Turin to Chivasso (86,000 volts); (3) the line from Goglion to Verampio (54,000 volts); (4) the connection of the Masino factory with the Plattamala-Lomazzo line, province of Como (45,000 volts); (5) the line from Anirolla Ifri (Sardinia) (32,000 volts); and (6) the Arco-Subiaco-Tivoli-Rome transmission line (30,000 volts).

Contrary to opposite reports which have been current, the *Giornale dei Lavori Pubblica* is able to state that no difficulty has been raised by either the French military or political authorities, and that electric traction will be extended to the 15 km. of the Cenisio Tunnel line on French territory worked by the Italian State Railways, the way being thus paved for the continuous electrification of the line as far as Modane.

Dudley.—The Tramways Committee has decided to join the Tottenham Council in an appeal to the Lords against the decision of the Court of Appeal that tramway companies shall be rated on assessments of one-fourth only of the annual value of their tramways.

East Kent.—The East Kent Light Railways Co. is applying to the Light Railway Commissioners for an order to construct a railway over four miles in length, from Little Mongeham, *via* Northbourne, Ham and Eastry, to Woodnesborough.

Elland.—Considerable disappointment has been occasioned by the failure of the project of the West Yorks. Tramway Co. to link Elland with Halifax and Huddersfield. The suggestion was that the company's lines should be connected with the Halifax system at West Vale, run through Elland, and join up with the Huddersfield tramways at Birkby. Support was given to the scheme by the Elland District Council, but negotiations have fallen through, and the project has been dropped.

Gateshead-on-Tyne.—At a meeting of the Birtley Council, on May 28th, a letter was read from the Gateshead Tramway Co., asking for the support of the Council to a proposed extension of the system to Birtley and Chester-le-Street. The proposal met with unanimous approval, and it was decided to ask the company for further details. At present the Gateshead Tramway Co. runs cars to Low Fell, which is on the Durham road, upon which also Birtley and Chester-le-Street are situated. Low Fell is about 3 miles from the Gateshead terminus, Birtley 4½, and Chester-le-Street about 7½.

Glasgow.—The Tramways Committee reports the breaking of another revenue record for the year ending May 31st. The total income was £987,280, compared with £946,021 for the previous year—an increase of £41,258. In 1910 the income was £893,591, and in 1909, £889,530. The big augmentation is accounted for by several reasons. The principal is the fact that, last summer, the Scottish National Exhibition was held in Glasgow. Two important experiments were made in the course of the year. The first was the two-stage ticket—a 1½d. transfer ticket, which permitted a passenger to take a double ½d. stage at the purchase of the ticket and complete a journey of similar distance at any time—and the second, which succeeded the "two-stager" in December, was the doubling of the ½d. distances over the entire routes. Considerable loss was entailed by the dislocation caused by the tramwaymen's strike in August of last year, while the coal miners' strike, while it brought an augmentation to revenue through increased long-distance passengers carried, also, through increased fuel prices, cut down profits. The details of the traffic are: Average track mileage open during year (single), 194⅝ miles—increase, ⅜ mile. Car-mileage, 22,435,076 miles—increase, 730,839 miles. Passengers carried, 275,610,385—increase, 37,643,078. Passengers carried per car-mile, 12·2—increase, 1·3. The number of passengers carried at each fare was:—

	Year to May 31st, 1912.	Year to May 31st, 1911.
½d.	121,212,468	66,290,055
First two stage	9,062,479	5,573,508
Second two stage	9,058,682	5,398,884
1d.	104,334,320	130,519,231
1½d.	20,337,702	19,408,739
2d.	6,258,659	5,879,305
2½d.	2,736,945	2,453,123
3d.	1,340,308	1,248,620
3½d.	1,109,998	1,036,083
4d.	158,824	159,759
Totals	275,610,383	237,967,307

For some time the Tramways Committee has been in negotiation with the proprietory company in connection with the acquiring of the Harbour tunnels in order to facilitate the working of the tramway traffic from the north to the south side of the Clyde and *vice versa*, west of Glasgow Bridge. The Corporation offered the company to clear the tunnels of the water which had accumulated in them during the years in which they have been disused, and to bring them into good working order at a cost not to exceed £1,200, with the option of purchase at £100,000 at the end of the year should the experiment prove a success. The company has declined the second part of the offer as too low for acceptance, and adheres to its price of 50 per cent., or 10s. per £ of the original total cost. The Committee is to reconsider the matter.

Halifax.—The T.C. has applied to the B. of T. for a loan of £3,750 for the provision of six new tramcars.

London.—The Roads Improvement Association having considered the report of the L.C.C. Committee on its recent memorial on the question of obstruction, &c., to the B. of T., has communicated with the latter, urging that it should hold an inquiry into the allegations, which it complains are not answered by the L.C.C. Committee's report.

Newcastle-on-Tyne.—At a meeting of the Corporation Tramways Committee on May 30th, the chairman submitted the annual statement for the year ended March 31st last. He stated that the receipts from traffic were the largest that had ever been earned on the system and amounted to £216,590, which included £1,812 for parcels. (This is equal to 11·317d. per car-mile.) The receipts from other sources were £5,492 for street lighting, £3,637 for advertising, which with other small items made a gross income of £226,634. (Equal to 11·841d. per car-mile.) The total working costs had been increased by £8,039, making the total expenses for the year £122,012, against £113,973 last year. (Equal to 6·375d. per c.m., as against 6·164d. per c.m.) There was left a balance of £104,622 to carry to the net revenue account, compared with £95,694 for the previous year. Interest on loans totalled £30,972, and there was carried to the appropriation account £73,433, compared with £62,933. The repayment of loans and sinking fund accounted for £39,314, £12,000 was given as a contribution to the rates, £12,250 was paid to the Newcastle Electric Supply Co. as compensation for giving up the right of supplying electricity in Walker, and there was left £8,427 net profit to be carried to the reserve and renewals account. The last account would now stand at £104,670. The chairman added that during the present year the Committee would have to spend £30,000 out of the renewals fund, for renewals of lines, junctions, and additional power at the generating station. During the year they had carried about 49,000,000 passengers, and their profit was about £32,000. But when they took into consideration that £14,000 of that amount was earned apart from traffic receipts, and when they considered that they ought to provide at least £11,000 for the year's contribution to the renewal funds, it would be seen how small a proportion of the profits were actual traffic receipts. The statement was adopted on the motion of Sir Joseph Ellis. It was decided to make a survey in the Heaton district, in connection with a proposal to extend the tramways in that part of the city.

Nottingham.—Councillor Swain, chairman of the Corporation Tramways Committee, stated at a meeting of the City Council that the Committee had considered the advisability of establishing the railless traction system in Nottingham, but nothing could be done at present, as they were awaiting the result of a Bill promoted by the B. of T. in the House of Commons to simplify the process of getting powers. As soon as the Committee knew its position he would bring the subject up again.

Presenting the annual report of the Tramways Committee, Councillor Swain said the receipts were £5,300 more than in the previous year. This was largely caused by the Coronation festivities and the fine summer, three-quarters of a million more passengers having been carried. The reduction of fares had made little difference to the receipts, and had given general satisfaction. Since the adoption of the halfpenny fares for children there had been an enormous increase, 97,000 tickets being issued last week.

Warrington.—The tramways department for the past year shows a net profit of £2,456; £1,500 has been kept in hand for the relief of the rates, and a further sum of £338 has been carried forward, and the balance of £618 has been transferred to the reserve fund, which now stands at £10,000. The debt extinguished to date is £25,802.

West Bromwich.—The Tramways Committee reports that the accounts of the tramways undertaking show that, after charging interest on loans and sinking fund instalments, the net profit amounts to £275, which extinguishes the deficiency of £239 brought forward, and leaves a balance of £53, which has been transferred to the repairs of track expense account.

Western Australia.—According to the *Standard*, the purchase of the Perth Tramways Co.'s undertaking by the State for £500,000 (which has been previously mentioned in these notes), has been completed.

TELEGRAPH and TELEPHONE NOTES.

Austria.—The reform of the Vienna telephone service will be accomplished within the next 10 years. It was originally intended to introduce the full automatic system, but the engineer department of the Post and Telegraph Administration gave its decision in favour of the semi-automatic system. Ten semi-automatic exchanges, for 10,000 subscribers each, will be established. Three of these exchanges will be built in the first instance. Under the stimulation of the orders placed in connection with these operations, Austrian electrical manufacturing firms are experiencing a period of unwonted prosperity, and several are enlarging their works. Among the latter are the Ericsson Austrian Electrical Manufacturing Co. and the Telephonfabriks-Aktiengesellschaft, both of which are making extensive additions to their works. In addition to the orders already placed, commissions for some 20,000 instruments of various kinds are in sight, besides large orders for telephone cable for the projected lines to Triest and Dalmatia, rendered possible by the 20,000,000 kronen credit for postal purposes included in this year's State Budget.

Cable Record.—It is stated that the special cable messages sent to the *Daily Telegraph* in connection with the loss of the *Titanic* and the consequent proceedings constituted a new trans-Atlantic record as regards dispatches addressed to one newspaper; 74,203 words were transmitted by the Commercial Cable Co., and 2,891 by the Anglo-American Co., a total of 77,094 words.

High-Frequency Machine.—Count Arco, the well-known inventor, to whose labours the technical development of modern wireless telegraphy owes much, has recently made a further important invention which is being taken up by the German Telefunken Co. The invention in question is a high-frequency machine for the direct production of electric waves for wireless telegraphy and telephony. Although the machine does not differ materially from the ordinary alternating-current machine, it is capable of generating any desired output at frequencies from 15,000 to 120,000 cycles per second, and, therefore, electric waves of lengths from 2,500 to 20,000 metres, which are necessary for large wireless stations. The machine is simple and cheap, runs at a moderate speed, and will produce waves at as high a frequency as may be desired. A machine for an output of 500 KW. is now under construction for the Nauen wireless station. Count Arco will explain and introduce his invention at the International Conference on Wireless Telegraphy which is now sitting in London.

International Radio-Telegraphic Conference.—The Conference was opened at the Institution of Electrical Engineers on Tuesday by the Postmaster-General, who nominated Sir H. B. Smith as President. Yesterday Mr. Samuel received the delegates at his house.

Liverpool.—Sir W. Hartley has presented to the University of Liverpool a wireless installation for experimental and research work, with standard Marconi apparatus as used on board ship.

Radio-telegraphic Convention.—The Senate of the U.S.A. has ratified the International Convention.

The Right to Strike.—A conference was held at Blackpool last week of the National Postal, Telegraph, and Telephone Engineering and Stores Association, at which a resolution was carried with only two dissentients, asserting the right of employés in the engineering and stores department to withhold their labour.

Venezuela.—According to an American Consular report, the President has issued a decree establishing four wireless telegraph stations at La Guaira, Puerto Cabello, Maracaibo, and Cumana. Wireless companies might address Spanish correspondence to the Department of Fomento (Promotion) at Caracas, or to Señor Manuel Ayala, 18, Broadway, New York City, who is the purchasing agent of the Venezuelan Government.

Village Telephones.—The P.M.G. has undertaken to establish telephone call offices at all villages where there is a likelihood of the offices being self-supporting, and these can be used for dictating telegrams to the nearest telegraph office.

Wireless at Sea.—It is reported from Berlin that new regulations will come into force on October 1st, according to which all German passenger steamers with a complement of 75 persons and upwards, inclusive of the crew, will be obliged to carry apparatus with a radius of at least 100 nautical miles. The same provision will apply to cargo vessels which regularly have more than 60 persons on board.

Wireless Telephony.—Experiments recently carried out by the Italian naval and military authorities have resulted in the transmission of speech with clearness over a distance of 160 miles.

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—The electrical engineer has been instructed to obtain tenders from local firms for the supply of some 2,800 yd. of terra-cotta troughs and covers, required as conduits for cables.

Australia.—Western Australia.—July 31st. Postmaster-General's Dept. Telegraph and telephone material. See "Official Notices" May 10th.

P.M.G., Melbourne.—July 23rd. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

N.S.W. Government Railways and Tramways.—July 1st.—200-kw. motor-generator set for the Ultimo Power House. Specifications from the Electrical Engineer's Office, 61, Hunter Street, Sydney.

New South Wales.—July 31st. Common battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" May 17th.

South Australia.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" May 17th.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" May 24th.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

Barnes.—June 11th. Concentric paper-insulated and lead-sheathed cable for the U.D.C. See "Official Notices" May 31st.

Belfast.—June 10th. Extension of the lighting and traction switchboards, for the Corporation. See "Official Notices" May 17th.

Belgium.—June 11th. The municipal authorities of Namur are inviting tenders for an installation of electric lighting in the new Kursaal.

June 11th.—Tenders are being invited by the Capitaine Commandant la Compagnie des Telegraphistes (La Caserne Front, 5-6), Antwerp, for the supply and laying of the sub-river and underground cables required in connection with the establishment of a telephonic system in the sector of the fortified portion of Antwerp.

Bristol.—June 10th. Wiring and fittings for electric lighting at Stapleton Workhouse, for the B. of G. See "Official Notices" May 24th.

British Columbia.—June 10th. The city of Vernon requires one 125-kw. three-phase 60-cycle generator with direct-connected exciter, five-panel switchboard, and series tungsten or arc lighting system. Tenders in duplicate to City Clerk. Consulting engineers:—Messrs. Mather, Yuill & Co., Ltd., Vancouver, B.C.

Briton Ferry.—June 19th. Overhead main, between Villiers Street and Grandison Hotel, for the U.D.C. See "Official Notices" to-day.

Bury.—June 21st. Electric light installation and borehole pump at the Aitken Sanatorium, Holcombe, for the Bury and District Joint Hospital Board. See "Official Notices" to-day.

Croydon.—June 24th. Conversion of two hand lifts into automatic push-button control electric lifts, at the Infirmary, for the B. of G. See "Official Notices" to-day.

Derby.—One water-tube boiler, for the Corporation Electricity Department. See "Official Notices" May 3rd.

Devonport.—June 8th. Cables, wires and house fuse boxes, for a year, for the Corporation. See "Official Notices" May 17th.

Dublin.—June 27th. Extra-high-pressure and low-pressure cables, for the Corporation. See "Official Notices" to-day.

France.—June 15th. The French Post and Telegraph authorities in Paris are inviting tenders for the supply of a multiple switchboard for the telephone exchange in the town of Tours.

The Chamber of Commerce of Havre have decided to erect 15 electric cranes, to replace the existing 15 hydraulic cranes, and also two electric cranes for the sheds of the Booth Line. Definite decisions have likewise been come to by the Chambers of Commerce at Nantes and Rouen for the installation of electric cranes and other works. At the former port it is intended to erect three electric cranes and to re-organise the electric conduit equipment; and at the latter port to erect two new electric cranes and a 130-h.p. hydro-electric pump.—*Revue Pratique de l'Electricité.*

Grays.—June 13th. Coal for a year for the U.D.C. electricity works. Electrical Engineer.

Hungary.—The municipal authorities of Csepel are about to invite tenders for the concession for the electric lighting of the town.

London.—Poplar.—June 19th. Renewal of sub-circuit wiring, fuseboards, &c., at the Workhouse, for the B. of G. See "Official Notices" May 24th.

June 8th.—Steam-driven boiler feed pump for the B.C. electricity works. See "Official Notices" May 31st.

Hackney.—June 27th. Boiler plant, induced-draught plant, economiser, feed pumps, coaling plant, pipework, travelling crane, turbo-alternator, motor-generator or motor-converter, switchgear, &c., for the B.C. See "Official Notices" May 17th.

Hornsey.—June 10th. One electrically-driven turbine feed pump, for the T.C. See "Official Notices" May 24th.

St. Pancras.—June 17th. Two sets of motor-generator balancers for the B.C. See "Official Notices" to-day.

Newcastle-upon-Tyne.—June 28th. Nine-ton electrically-driven crane for use in connection with an anti-coal breakage appliance at No. 5 Coal Shipping Staith, Whitehill Point, for the Tyne Improvement Commission. Deposit £1. Mr. J. M. Manson, general manager and secretary, Tyne Improvement Commission.

Rochdale.—Contract A 62.—Cable conduits. Contract A 63.—One three-phase motor-alternator. Particulars from Mr. C. C. Atchison, engineer and manager, Dane Street.

Oldham.—June 21st. Steam, exhaust, drain and condenser pipes, oil separator, &c., for the Corporation Electricity Committee. See "Official Notices" May 31st.

Salford.—June 10th. Electric wiring of Nashville Street Council school. See "Official Notices" May 31st.

South Africa.—June 26th. Boksburg. Rolling stock, converter plant and overhead material for the railless trolley system. See reference to this matter in E.R., May 17th.

Spain.—July 2nd. Electric lighting of the City of Oviedo and its municipal buildings, for the Municipal Council. Board of Trade Commercial Intelligence Department, London.

Stockport.—June 11th. One or more 1,500-kw. mixed-pressure turbine alternators, for the Corporation. See "Official Notices" May 24th.

Sweden.—June 22nd. Swedish Royal Board of Waterworks. (1) 11,250-h.p. three-phase generator, 10,000 volts, 150 r.p.m.; transformers for raising to 70,000 volts. For State power station at Alfkarleby. For further particulars see this column last week.

Swindon.—June 22nd, Steam coal, for the Corporation. See "Official Notices" to-day.

Turkey.—June 15th. Tenders are invited for the establishment of electric tramways in the Asiatic part of the capital. Particulars, in French, from the Minister of Public Works on forwarding the equivalent of 10s. in Turkish money (half of £T).

Uruguay.—Montevideo.—June 20th. Tenders are invited for the supply and erection of four electric turn-bridges of 1,500 kg. each, with 800 metres of rails, for the Customs warehouses. Terms, &c., Harbour Secretary, Calle Piedras No. 156, Montevideo.

West Ham.—June 17th. Installation of electric light at the Education Offices, The Grove, Stratford, and Colegrave Road schools, Stratford, for the Education Committee. See "Official Notices" May 24th.

CLOSED.

Accrington.—The Electricity Committee has accepted the following tenders :—

British Westinghouse Electric & Manufacturing Co., Ltd.—Transformer and regulators, £284.
Dussek Trinidad Bitumen Co.—15 tons of bitumen, at £5 17s 6d. per ton.

Australia.—Postmaster-General's Department, Sydney :

300 telephones, £787 10s.—J. Paton & Co.
One branching multiple magneto switchboard, with associated frames, racks and parts, for Post Office, Broken Hill, £3,277.—B.I. & Helsby Cables, Ltd.
Protectors, £435.—Western Electric Co. (Australia), Ltd.
One switchboard section at the telephone exchange, Edgecliff, £765; one switchboard section at the telephone exchange, William Street, £658; one switchboard section at the telephone exchange, Mosman, £939; total £2,362.—Western Electric Co. (Australia), Ltd.

Postmaster-General's Department, Perth :—

3,500 conduits, glazed eathenware, six ducts, at 5s. 9d. each, £1,006; 2,500 conduits, glazed earthenware, six ducts, at 5s. 9d. each, £719.—Mills and Co., Perth.
80 relays, polar, differential P.O. pattern, at £4 19s. 6d. each, £149.—I.-R., G.-P. & Telegraph Works Co., Ltd., Perth.
2,500 cells, dry, rectangular, at 2s. 10d. each, £354.—General Electric Engineering Co., Perth.

The P.M.G.'s Department in Melbourne has placed a large order for protectors, fuses, switchboards, condensers, lugs, relays, resistances and switchboard cable, with the Western Electric Co. (Australia), Ltd. Also one for keys, repeating coils, &c., with Jas. Bartram & Son, Ppty., Ltd. ; and one for 300 c.i. covers and frames, at £3 10s. each (£1,050), with Holden & Lewis.

The P.M.G.'s Department at Sydney has ordered additions to switchboard at Sydney G.P.O. from the Western Electric Co. (Australia), Ltd., at £4,774.

The P.M.G.'s Department has also ordered cords and ear-pieces from the Lawrence & Hanson Electrical Co., Ltd., and the I.-R., G.-P. and Telegraph Works Co., and cords from the Western Electric Co. (Australia), Ltd., and copper binders and tapes from the B.I. and Helsby Cables, Ltd., and the I.-R., G.-P. & Telegraph Works Co., Ltd.

Tenders for plant for electricity supply at Ararat (V.) have been accepted by the Council, and an immediate commencement will be made with the erection of the plant and the reticulation of the town. Messrs. R. Hornsby & Son secured the contract for two gas engines, the price being £1,523 10s. Several tenders for equipment were accepted, the largest being that of Warburton, Franki & Co., £680. Contract E, supply of aluminium wire and cable, £337, was gained by the B.I. & Helsby Cables, Ltd. Messrs. McLean & Co. will have charge of the erection of the plant, their contract amounting to £588. The whole of the work will be superintended by Messrs. G. B. Lincolne and K. MacDougall, of Melbourne.—*Australian Mining Standard.*

Sydney Municipal Council has, says the *Australian Mining Standard*, received the following tenders for a 11,000-volt cable :—

W. T. Henley's Telegraph Works Co., Ltd.	£3,684
Noyes Bros. (Sydney), Ltd.	3,725
Australian Metal Co.	3,772
B.I. & Helsby Cables, Ltd.	3,882
Western Electric Co.	4,170

The same exchange reports the following acceptances of tenders by the New South Wales Public Works Department, Irrigation and Drainage Branch :—

Supply and erection at Yanco of engine and generator and exciter, £65; electrical generating set and transformer for Yanco, £840.—Cowlishaw and Rumford, Sydney.
Boiler, fitted with patent integral steam superheaters, for Yanco, £789.—Babcock & Wilcox, Ltd.

The *Melbourne Age* states that tenders for the power plant for the Federal capital electricity generating works were opened on April 25th at the Home Affairs Department, and were referred to the works officers for report. They number about 20, and have been received principally from Australian agents of European and American firms. The plant is to be of 600 KW., and will form part of the central station when the progress of construction warrants the use of more than one unit.

Barking.—The T.C. Tramways Committee has accepted the tender of the British Thomson-Houston Co., Ltd., at £768, for a single-truck tramcar.

Bolton.—The Electricity Committee has accepted the following tenders :—

British Westinghouse Co.—Motors.
Ferranti, Ltd.—A.C. meters.
Electrical Apparatus Co. and the General Electric Co.—D.C. meters
L. Andrew & Co.—Tapes, incandescent lamps, and I.R. gloves, &c.
Henley's Telegraph Works Co.—Oil tape, service and other boxes.
Siemens Bros. & Co.—Adhesive tape and H.T. compound.
Union Oil & Bitumen Co.—Resin oil.
Western Electric Co.—Solder and plumbing metal.
Ward & Goldstone.—Porcelain cleats.
B.I. & Helsby Cables, Ltd.—Insulated wires, boxes, pavement frames, covers, cut-outs, sealing boxes, &c.
Lucy & Co.—Cut-outs.
Edison & Swan Co., Johnson & Phillips, British Electric Transformer Co., W. E. Burnand & Co., and the Brush Electrical Engineering Co.—Transformers.
Electrical Apparatus Co.—Motor starters.
T. Moscrop & Co. and W. Priestley & Co.—Oils, &c.
G. Reason.—Waste.
Fisher, Raworth & Co.—Bolts, nuts, and sundry stores.
Brabbin & Budd.—Asbestos and india-rubber goods, &c

Belgium.—M. L. C. Jause submitted the lowest tender for the supply and installation of four new boilers, with economisers, for the central electric lighting station in Ghent.

Derby.—The E.L. Committee of the T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for a boiler, at £2,190.

Eastbourne.—The tender of the British Westinghouse Co. has been accepted by the T.C. for a six months' supply of electricity meters.

Edinburgh and Govan.—At both these places the tender of Messrs. Chamberlain & Hookham for electricity meters for the coming year has been accepted.

Falkirk.—The Corporation has accepted the tender of th Reason Manufacturing Co., Ltd., for electrolytic meters for the ensuing year.

Galway.—The U.D.C. has decided to have the Esplanade at Salthill, Galway, lighted by electricity, and has accepted the tender of the Galway Electric Co., Ltd., for a period of seven years.

Glasgow.—The Tramways Committee has placed the following contracts for the year :—

Steel wheels.—John Baker & Co., Ltd.
Steel tires.—Brown, Bayley's Steel Works, Ltd., John Baker & Co., Ltd.
Steel axles.—Glasgow Railway Engineering Co., Ltd.
Bolts and nuts, &c.—Thos. Tudhope & Co., Rivet, Bolt & Nut Co., Ltd.
Rubber-insulated cables.—W. T. Glover & Co., Ltd., W. T. Henley's Telegraph Works Co., Ltd.
Iron castings.—R. Howie & Co., David King & Son.
Steel castings —Dickson & Mann, Acme Steel & Foundry Co.
Malleable-iron castings.—A. Shanks & Son, Ltd
Engineers' furnishings.—Wm. Landell, Pegler Bros., and Mitchells, Ashworth & Co., Ltd.
Chilled brake blocks.—Wm. C. Yuille & Co., Ltd., Miller & Co., Ltd., and The Interchangeable Block Co., Ltd.

Grimsby.—The tenders of the Phœnix Dynamo Manufacturing Co., Ltd., and the Tudor Accumulator Co., Ltd., have been provisionally accepted by the T.C. for a motor-generator and switchgear, for £420, and an automatic booster and switchgear, at £332, respectively.

Hounslow.—In connection with the extension of plant at the electricity works, 59 tenders were received. Reporting on these tenders, the Electricity Committee stated that the lowest tender received for the engine and foundations was that of Messrs. Browett, Lindley & Co., at £1,544. The engine quoted for by this firm had the following advantages :—(1) low initial cost ; (2) low steam consumption ; (3) occupied less floor space than other makes ; (4) slower speed. It would also be entirely suitable for the Council's requirements. The steam consumption per KW.-hour was 10 per cent. less than that of any of the other makes, and the initial cost of the engine was some £200 less. The reduction in speed would necessitate the adoption of a slightly larger dynamo at a slightly increased cost, but it was obvious that the reduced speed would entail less wear and tear on the plant, and was consequently a great advantage. The engine installed at the electricity works by the same firm two years ago was giving entire satisfaction. Should the new engine fail to fulfil the firm's guarantees in every respect, it was to be replaced with a triple-expansion engine, without any additional cost other than the difference in price for the two engines. As regards the dynamo referred to above, the Committee favoured the tender of the General Electric Co., Ltd., at £1,212. As, however, it was desirable that the complete contract should be given to one of these firms, and as the engine builders had agreed to work in conjunction with any dynamo maker, either maker agreeing to take the complete contract at the price quoted, the Committee had decided to give the whole contract to Messrs. Browett, Lindley & Co., Ltd., at a total of £2,766. For the supply of a boiler, &c., the Committee recommended the acceptance of the tender of Messrs. Babcock & Wilcox, Ltd., at £1,698. The Committee further recommended the acceptance of the tender of Messrs. Browett, Lindley & Co., at £998, for the condensing plant required. At the Council meeting all the recommendations were carried.

Leyton.—The U.D.C. has accepted the tenders of Venner & Co., Electrical Apparatus Co., Ltd., Siemens Bros. & Co., Ltd., and the British Insulated & Helsby Cables, Ltd., for supplies of motor, ordinary and slot meters, as and when required, for a period of one year.

Liverpool.—The Liverpool District Lighting Co., Ltd., have received instructions to light by electricity the Cavalry Barracks at Seaforth near Liverpool.

London.—ISLINGTON.—The Guardians have accepted the tenders of the General Electric Co., Ltd., Drake & Gorham, Ltd., and Baxter & Caunter, Ltd., for electrical fittings and sundries.

HAMMERSMITH.—The following tenders were received for a number of recording voltmeters :—

Everett, Edgcumbe & Co.		£140 10
Nalder Bros. & Thompson		141 10
Evershed & Vignoles		141 10
Nalder Bros. & Thompson	(alternative)	151 10
General Electric Co., Ltd.		151 10
Johnson & Phillips, Ltd.		151 10
Elliott Bros.	(recommended)	151 10
British Westinghouse Co., Ltd.		281 12

Amongst other orders recently placed by the South-Eastern and Chatham Railway Co., is one for 144 Westinghouse 10-amp. 45-hour magazine flame arc lamps.

SOUTHWARK.—The B.C. has accepted the tender of the British Insulated & Helsby Cables, Ltd., at £43, for the provision of a feeder pillar.

SHOREDITCH.—The B.C. has accepted the tender of the Western Electric Co., Ltd., for the supply of approximately 2½ miles of six-core, paper-insulated, lead-covered pilot cable, at £114 per mile. The other tenders were :—

	Per mile.
Siemens Bros. & Co., Ltd.	£115 10
W. T. Glover & Co., Ltd.	115 15
W. T. Henley's Telegraph Works Co., Ltd.	117 0

An order is to be placed with Messrs. Elliott Bros. for ten recording instruments, at £11 1s. 6d. each.

Northampton.—The T.C. has accepted the tender of Messrs. Mather & Platt, at £168, for centrifugal pumping plant and electric motor.

Nuneaton.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a main switchboard, at £654 ; and that of the Electrical Engineering & Equipment Co. for cables, at £877. The latter contract is in place of that of Messrs. Blackwell & Co., who have declined the contract previously placed with them

The Rand.—An order for eight high-pressure centrifugal pumps of 500 H.P. each has been placed with Messrs. Escher Wyss and Co. by Messrs. Hubert Davies & Co., for the new pit of the Rand Proprietary Mines. Each pump has to lift 60,000 gallons of water (acid-containing) per hour, against a vertical head of 1,150 ft. The pumps have to work under very unfavourable conditions, and are therefore of very strong design and special acid-resisting material.

Salford.—The following tenders have been accepted by the T.C. :—

Babcock & Wilcox, Ltd.—Electrically-operated travelling jib crane, bulk weigher and tray conveyor for coal, £4,698.
W. Thorpe & Son.—Alterations to buildings and foundations at electricity works to accommodate two turbo-generators, £1,369.

ANNUAL SUPPLIES.

Chamberlain & Hookham, Ltd.—Continuous-current meters, approximate value of contract £546.
General Electric Co., Ltd.—Ditto, £120.
Electrical Co., Ltd.—Motor carbon brushes, £24.
William Geipel & Co.—Rubber cables, £150.
W. T. Glover & Co.—Ditto, £200.
W. T. Henley's Telegraph Works Co.—Rubber strip and black tape, £46.
Plutte, Scheele & Co., Ltd.—Arc lamp carbons, £83.
L. Andrew & Co.—Rubber solution, white tape, copper strip, mica, and rubber gloves, £22.

The following have been accepted in lieu of that of Imeson Finch & Co., Ltd. :—

Biennial supply of mechanical car accessories.—Malleable Steel Castings Co., Ltd., Brecknell, Munro & Rogers, Ltd., Johnson, Clapham and Morris, Ltd. (£225), W. Boydell & Sons, Ltd.
Special car accessories.—British Westinghouse Co., Ltd.

South Africa.—Contracts have recently been awarded by the Union Tender Board, Pretoria, on behalf of the Public Works Department, as follows :—A.E.G. Electrical Co., carbon lamps ; Siemens, Ltd., tungsten lamps ; British General Electric Co., Ltd., conduits and fittings ; Hubert Davies & Co., Pretoria, cables ; Henley's S.A. Telegraph Works, Ltd., cables ; Telegraph Manufacturing Co., cables.—*Commercial Intelligence.*

FORTHCOMING EVENTS.

Institution of Mining Engineers.—Friday, June 7th.—At 9.40 a.m. (from Fenchurch Street). Visit to the works of the Western Electric Co., Ltd., North Woolwich.

Institution of Electrical Engineers.—Summer meeting at Glasgow.
Wednesday, June 12th.—At 10.30 a.m. At the Royal Technical College. Paper on "The Transmission of Electrical Energy by Direct Current on the Series System," by Mr. J. S. Highfield. At 2.15 p.m.—Visit to works (to be selected). Ladies' excursion. At 8 p.m.—Reception in the Municipal Buildings by the Lord Provost and Corporation.
Thursday, June 13th.—At 10.30 a.m. At the University. Lecture on "The Magnetism of Permanent Magnets," by Prof. S. P. Thompson ; description and demonstration of "A Single-Phase Motor with Pole-changing Windings," by Messrs. J. S. Nicholson and B. P. Haigh. At 9.30 a.m.—Excursion to Edinburgh and Holyrood Palace. At 2.15 p.m.—Visit to works (to be selected). At 8 p.m.—At the University ; reception by Principal Sir Donald Macalister.
Friday, June 14th.—At 9.35 a.m. Excursion on the Firth of Clyde. At 8 p.m.—At the Grosvenor Restaurant. Dinner.

Physical Society.—Friday, June 14th. At 8 p.m. At the Imperial College o Science, South Kensington. Papers on "Demonstration of a Method o Determining very Small Differences of Density," by Mr. T. H. Blakesley ; "The Maximum Sensibility of a Duddell Vibration Galvanometer," by Dr. H. F. Haworth ; and "An Accurate Examination of the Steinmetz Index for Transformer Iron, Stalloy and Cast Iron," by Mr. F. Stroude.

Newcastle Chamber of Commerce (Electrical Section).—A meeting was held on May 29th in the Mayor's Chamber, Guildhall, Newcastle-on-Tyne, to consider the question of forming an electrical section of the Newcastle and Gateshead Chamber of Commerce. Mr. C. S. Vesey Brown presided. After some discussion, on the motion of the chairman, seconded by Mr. W. C. Mountain, it was resolved to form an electrical section of the Chamber. Those present, who included (in addition to those mentioned) Messrs. T. O. Hunt, W. C. Wilson, B. Gaffney, R. Robson, W. P. Potter, R. Jobson, H. S. Ellis, C. Turnbull, G. E. Carr, and H. Shaw (secretary), were formed into a Provisional Committee. It was announced that the Newcastle Branch of the Institution of Electrical Engineers would become members of the Section, and would nominate one of their members to serve on the Committee.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Drills, &c., are suspended from June 10th until October 7th, 1912, for all companies.
Saturday, June 15th.—Berehaven Camp. The party for this Camp will parade at headquarters at 12 noon. Dress :—Service dress, putties, haversack, waterbottle, belt and frog, greatcoat with one greatcoat strap (issued at headquarters) to be rolled *en banderole*.
Arms will be issued at headquarters from 12 noon. Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

NOTES.

The Engineer as Arbitrator.—The following interesting paragraph appears in the current minutes of the Hammersmith Borough Council :—

"A letter (25/3/12) has been received from the Bristol Corporation, stating that it is their practice, in common with many other local authorities, to insert in contracts for the execution of extensive works, a clause referring disputes under the contract to the arbitration of their own engineer. The Corporation point out that the validity of the clause was established in the case of Jackson *v.* Barry Railway Co. (1893, 1 Ch. 238), and experience has proved that it is a very necessary provision in the interest of employers, because it prevents contractors from bringing pressure on the engineer to decide in their favour the numerous points arising in the execution of large works, by constantly threatening an appeal to arbitration against the engineer's decisions. The Court of Appeal, in the case of Aird *v.* the Corporation of Bristol, have, after expressly exonerating the engineer from all the charges of conduct unfitting him for the position of Arbitrator made against him by the plaintiffs, refused to refer the matters in dispute to his decision, on the ground that out of a large number of disputes, two items (amounting to less than one-fourth of the total claim) did not fall within the arbitration clause. The Bristol Corporation are of opinion that the case involves a principle of great importance to local authorities, and counsel have advised that it is a case in which an appeal might properly be taken to the House of Lords. Very considerable expense has already been incurred in contesting this matter, and the Corporation are disinclined to go further unless they can obtain some assistance ; and inquire whether, in view of the uncertainty now existing as to the form in which contracts for works should be prepared, the Borough Council would be willing, with others, to join in sharing the cost of an appeal to the House of Lords."

The Hammersmith Committee that considered the letter recommends :—"That no action be taken in the matter."

Law Cases.—The *Financial Times*, in the course of an article on the list of trials that are to come before the Law Courts at the present Trinity sittings, mentions that the arbitration proceedings relating to the acquisition of the National Telephone Co.'s undertaking will begin on Monday next, June 10th, before Mr. Justice A. T. Lawrence, the Hon. A. E. Gathorne Hardy and Sir James Woodhouse. Numerous counsel have, of course, been engaged, the principals being the Attorney-General for the Crown, and Sir Alfred Cripps, K.C., for the company. The proceedings are expected to last until the end of the term. In the Winding-up Court there is, amongst the new petitions, one against the Maxim Lamp Works, Ltd. In the Appeal Court there is to be the appeal of the "Z" Electric Lamp Manufacturing Co., Ltd., against the order made by Mr. Justice Warrington, in the action brought against them by the Osram Lamp Works, Ltd.

Police Lanterns.—An evening paper says that electric bull's-eye lanterns are to be provided for the Metropolitan Police.

Strike Effects.—A good instance of the evil effects of strikes on the trade of this country recently came to our notice. During the coal strike a certain South American port, which formerly insisted on having Welsh coal only, was obliged to purchase 15 steamer loads of American coal. The Americans had always failed previously to get their coal into the port and through it to the country. Now that the American coal has once been tried, the orders go to America instead of England. What a lesson this should be to our workmen, who are so often blindly led by paid agitators, thus permitting our legitimate industries to fall into the hands of foreign competitors !

New Source of Rubber.—An African exchange says that the "Tirucalli" tree of Natal, which has hitherto been regarded as commercially useless, has been found to yield a latex which contains rubber. A Singapore rubber planter first drew attention to the matter, and a company which has been working a concession in the Tugela Valley has exported about a ton of the crude congulum weekly to London for some months, it having been found useful for electrical insulation and mixing with Para rubber. An unlimited number of tirucalli are found in Natal, and their recuperative qualities are such that they can be tapped once a month by experienced hands.

American Industrial Affairs.—It appears that the electrical industry in the United States has been subjected in most of its branches to the same depression that has been affecting the general business situation there for the past year or two, and at present, according to the American *Electrical Review and Western Electrician*, there is little indication of any reaction from this condition. Our contemporary, in dealing with the matter under the title "Industrial Regulation," says:—

"In some quarters the general business situation has been attributed to the Government's activity in enforcing the Anti-Trust Laws. While this may have contributed somewhat to the existing uneasiness, it is probable that its effect has been overrated. In the two cases that were carried to the Supreme Court the results were not at all disastrous to the defendants, and have in no way impaired trade in those particular channels. As for the prosecution, which was started about a year ago against the 'Electric Trust,' a very amicable settlement was reached by the attorneys for the Government and for the companies affected, and neither the situation in the electrical industry nor the volume of trade can be said to have been at all affected by this proceeding. It is certainly desirable, nevertheless, that the Government should arrive at some definite policy regarding its attitude toward, and treatment of, the large business and industrial corporations of the country."

Our contemporary, later in its article, says that the natural tendency of the present generation is toward co-operation rather than competition, and that a policy which depends upon the latter seems to be a grievous mistake. "The Government's efforts toward relief from the oppression of large industrial combinations should take the form of regulation with the idea of co-operation as the ultimate goal, rather than an attempted forcing of business back into the old lines of competitive method."

Some interesting comments appear in a recent report by the British Consul-General in the U.S.A. respecting the importance of foreign markets and the difficulty of American traders in securing or maintaining a footing unless the cost of production can be reduced. The report says:—

"Foreign markets are absolutely necessary to secure full employment for American mills, but the high American tariff, while it has carefully protected the home market, has, together with the eight-hour day, increased the cost of production to such an extent that it is difficult to meet the prices of the British and German manufacturer. It is maintained by some that if America is to have her full share of the foreign trade, the cost of production must be reduced to the level of its competitors, and this can only be done by improving the methods of financing, by systematic management, with the lowering of tariffs and a general reduction in wages paid. Whether the American working man will agree to the last condition is a matter of some doubt. He will probably suggest that, if retrenchment is necessary, the employers' profits should contribute towards that end."

The New York correspondent of the *Times*, in discussing "Business in the United States," mentions that the filing of a civil suit two or three weeks ago for the dissolution of the Aluminium Co., of America, charged with being a monopoly to restraint of trade under the Sherman Anti-Trust Law, marks the successful conclusion of long negotiations between officers of the U.S. Department of Justice. The writer, who enters into the relations of the American and European aluminium companies, says that "the suit is a friendly one and will not be contested, since the company has already promised to re-organise so as to comply with the Anti-Trust Act; in fact, a decree to this effect has been agreed upon between the Government and the Department, and will be entered in the near future."

Wireless Power.—According to the New York correspondent of the *Daily Telegraph*, in an address before engineers at Buffalo recently, Mr. Frank Prentice, a well-known Canadian expert on electric traction, predicted that the use of wireless power would in a few years be greatly extended, and he foresees the day when motor-trucks, flying machines, and even trains, will be operated by such power. He declares that recent experiments demonstrate that wireless power really increases in velocity and strength the further it goes from the point of origin.

The significance of this paragraph (literally) lies in its last sentence. It appears that the speaker has discovered a new law, diametrically opposed to the ordinary law of inverse squares; clearly, on the basis of this principle, if you can get far enough away from your source of power, there need be no limit to the power developed at the far end of the system—the only question is whether there is room enough on the earth for the purpose. If so, it will readily be seen that, by transmitting the unlimited wireless power thus collected back to the point of origin, the power of the source can be indefinitely increased, and thus at last we realise the long-sought perpetual motion.

Victoria Falls Power Employés.—We have received two Johannesburg newspapers containing articles "by a Special Correspondent," in which ridicule is poured upon many irksome regulations and restrictions which are imposed upon the employés connected with the Victoria Falls Co.'s power stations. The articles form curious but interesting reading. The writer talks of "the threatened strike in the V.F.P. camp" being mainly attributable to the "retrenchment-cum-replacement system in vogue," also of "unrest and discontent," due to "petty oppression," which had since been "modified for obvious reasons." The stipulation that all shift men and others must live on the property, and the inspection of quarters (married and single) once a month by the engineer in charge or station superintendent, call forth comments respecting the "V.F.P. Barracks," "A White Compound," and so on. The writer suggests that it is courting a big disaster to have only one tender for 16 boilers, and only one driver on night shift for the turbines, representing something like 2,500 H.P.; he also touches upon other matters which seem to be a source of irritation and friction.

Electricity Supply Rifle League.—The following are the results of the matches shot during May in connection with the above League: Central (Law. Greenwood 96) 558 *v.* Stepney (Barber, Jager 91) 531; Hackney (Hilling 94) 543 *v.* Stepney (Barber 98) 543; Ilford (L. Tufnell 90) 518 *v.* Shoreditch (Weekes 99) 564; Hackney (Hilling 96) 533 *v.* Shoreditch (Weekes 100) 551; Ilford (Partington 91) 530 *v.* Westminster (Neville 97) 572. The following is the position of Clubs to date:—

Club.	Matches. Shot.	Won.	Lost.	Drawn.	Points.	Scores. For.	Against.
Central ...	4	3	1	0	6	2,226	2,193
Westminster	3	3	0	0	6	1,705	1,620
Shoreditch ...	3	2	1	0	4	1,669	1,619
Stepney ...	3	0	2	1	1	1,619	1,666
Hackney ...	3	0	2	1	1	1,616	1,649
Ilford ...	2	0	2	0	0	1,048	1,136

The honour of putting up the first "highest possible" has been gained by Mr. Weekes, of the Shoreditch Club.

Fatalities.—A correspondent says that Arthur Francis Denholm, 21, a clerk employed in an insurance office at 71, George Street, Edinburgh, went to the basement of the building to turn off the electric current in connection with the lift, and while thus engaged he caught hold of a lever, with the result that he received a shock from which he died a few minutes later.

While erecting an electric lift at Paternoster Row, E.C., Alfred White, 44, fell a distance of 74 ft. to the bottom of the well. He died from fractured skull and other injuries. A verdict of accidental death was returned.

An inquest was held last Saturday into the death of Frank William Brown, an electrical engineer, aged 23, son of Mr. W. J. Brown, for 20 years manager of Messrs. Siemens's works, at Charlton. Deceased, according to the evidence, was out motor-cycling with friends, when a collision with a cab occurred. Brown and one of his companions fell with the machine on the top of them, and the cab horse also fell upon them. Deceased's left lower jaw was broken, and his skull was fractured; death was due to concussion and the fracture. Verdict: "Accidental death."

Electrical Trade at Johannesburg.—The annual report of the Johannesburg Chamber of Commerce for 1911, which is reproduced in the *South African Mining Journal* for May 4th, contains the following paragraph relating to the electrical trade: "Electrical business during 1911 showed a considerable falling-off as compared with 1910, owing to most of the orders for the construction work on the power companies' plants and on the mines in connection with the electrification scheme having been placed in the former year. Prices ruled extremely low, owing to severe competition, but, towards the end of the year, they were advanced somewhat in view of the risk of the heavy penalties now being inflicted by the mining houses."

Injuring Cable.—At the Lochgelly Burgh Court last week two young miners, named Joseph Faulds and James Smith, were charged with tampering with one of the Fife Electric Power Co.'s cables, by throwing a piece of barbed wire over it, in consequence of which the Leven and District Tramways were held up for four hours until the fault was discovered. The accused were each fined 10s.

The Joint Committee on Textile Mill Driving.—From the report of the textile section of the Joint Committee, appointed by the Textile Institute and the I.E.E. to inquire into the question of mill driving, it appears that such strong objection has been raised to the constitution of this Committee, that the Joint investigation will not be proceeded with, although a Standing Committee of the Textile Institute will carry on the work and report regularly on new developments. At the autumn meeting of the Institute at Hawick (September 12th-14th) papers on the driving of mills by steam, electricity, gas and oil are included.

Nitrate Production from the Raw Material of Aluminium.—The *Financier* quotes the following information from the report by H.M. Consul at Lyons (Mr. E. R. E. Vicars) on the trade of that district in 1911, which will shortly be issued: The most important development in the electro-metallurgical industry during 1911 related to the production of aluminium and its by-products, the French manufacturers of which have formed themselves into a company called "L'Aluminium Français," with a share and debenture capital amounting to £680,000. The most interesting part of this combination lies in the fact that the new company have acquired the exclusive rights all over the world in the Serpeck process of aluminium manufacture. The Serpeck process, by which the production of nitrates forms part of the manufacture of aluminium, consists in the treatment of bauxite in the electric furnace with air and coke so as to fix the nitrogen, thus producing a nitride of aluminium. This product is then treated with a solution of caustic soda, which produces aluminate of soda and ammonia gas. From the aluminate of soda is extracted pure alumina, and from this aluminium is obtained by the usual electrical process, while the ammonia gas is treated with sulphuric acid, producing sulphate of ammonia. The process is thus closely allied with that in use for the production of nitric acid and nitrates by the union of oxygen, nitrogen and steam in the electric furnace.

Institution and Lecture Notes.—THE FARADAY SOCIETY.—Preliminary particulars have been issued respecting a proposed 15 days' visit of members of this Society to Norway and Trollhättan, Sweden, in July or August next. The cost of the tour per head, starting from Hull and returning to Newcastle, including all travelling and hotel expenses and gratuities, will be 25 guineas. The visit has been suggested by several eminent Norwegian electrochemists, and excellent opportunities should be afforded for inspecting some of the principal hydro-electric power installations and electro-chemical and electro-metallurgical plants, provided a sufficient number of members and friends are able to take part in the tour. Particulars may be obtained from the secretary, Mr. F.S. Spiers, 82, Victoria Street, S.W.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—At the annual meeting of the East of Scotland Branch, on the 25th ult., Mr. C. A. Carlow, of the Fife Coal Co., was re-elected President, for the third year in succession. Mr. R. H. Willis retired from the secretaryship, on his appointment as general manager for his firm, the British Electric Plant Co., at their headquarters in Glasgow. Mr. H. Gorton Fraser, Leven, was re-elected vice-president, and Mr. R. W. Peters, Lochgelly, agreed to take over the joint posts of secretary and treasurer. Mr. Neil A. Wilkie, manager at Bowhill for the Fife Coal Co., then read a paper on the new special rules as applicable to electricity in mines.

NOTTINGHAM ENGINEERING SOCIETY.—To-day (Friday) the members of this Society leave Nottingham for Newcastle and Tyneside for their annual summer excursion. To-morrow they will visit the St. John Leather Works, Newcastle, and the works of Messrs. Clarke, Chapman & Co., at Gateshead, and other places of interest. On Sunday the N.E. Railway electro-pneumatic signalling works, power station, and pneumatic signalling box will be visited. On Monday the works of Messrs. Haggie Bros., Ltd., at Gateshead, and the engineering and shipbuilding yard of Messrs. W. Doxford & Sons, at Sunderland, are to be seen, after which the return to Nottingham will be made. The members of the Birmingham Engineering Society are to visit Nottingham on June 17th, and they will be met by the president and Council of the Nottingham Engineering Society.

JUNIOR INSTITUTION OF ENGINEERS.—A party of members recently paid a visit to the new engineering workshop and laboratory and the electrical laboratory of the Polytechnic, Regent Street. With the exception of a few of the best lathes and machines removed from the old workshop, the whole of the contents of the new shop, including many modern high-speed tools, is new equipment.

Mr. Hibbert conducted the party round the electrical workshop and laboratory, of which he is the head, and supplied the following particulars. Power is obtained from the mains of the Marylebone Borough Council at 480 volts, and by means of a series of eight motor-generators the laboratory is supplied with direct, alternating and polyphase currents. The laboratory contains series, shunt and compound motors, single, two-phase and three-phase motors, rotary converters, transformers, oscillographs, a telephone exchange (including a small working automatic exchange), arc lamps and all the usual appointments.

In connection with this Institution, a week-end visit to Sheffield is being arranged. The party will leave London for Baslow on June 21st, and will visit Haddon Hall and other places of popular interest on the Saturday, and on Monday the party will leave Baslow for Sheffield, visiting the works of Messrs. Firth & Sons, Ltd., and Messrs. Cammell Laird & Co., Ltd., returning to London in the evening. A movement is on foot to form a local section of the Institution in Sheffield, and it is thought that probably this visit will have the result of establishing the section.

No Takers at 15s.—At the Eccles T.C. on Monday, reference was made to an advertisement by the Lighting Committee for a switchboard attendant at a salary of 15s. a week. A member asked what was the minimum wage and requisite age of applicants, and Alderman Pearson, the chairman, said the minimum wage was 15s. a week, but receiving no reply to the advertisement, they raised it to £1, and had since made the appointment. They expected a well educated youth of 18 to 22, who would regard the appointment as a stepping stone to something better.

Speaking Pictures.—A demonstration was recently given at the Royal Institution by Prof. W. Stirling, of the Gaumont "speaking kinematograph" system. By means of electrical apparatus the inventor, M. Léon Gaumont, has succeeded in synchronising the operation of the phonograph and the kinematograph so that the sounds correctly accompany the appropriate action shown on the screen. Each instrument is driven by an electric motor, the two motors being of identical pattern and driven from the same source; the talking machine is driven at constant speed, and the speed of the kinematograph is adjusted to correspond with it by means of a differential gearing.

Tennis.—A match has been arranged between the Old Centralians tennis team and the City and Guilds (Engineering) College on Saturday, and it is hoped that in future this will be an annual event. Old students are invited to be present as spectators. The match will be played on the "Ryhall" Tennis Club ground, Barons Court Road, S.W. (opposite Barons Court Station). Play will commence at 3 p.m. There will be an informal supper afterwards at 7.30 p.m. at the Imperial Technical College Union Rooms.

The Horticultural Exhibition.—With reference to the notice in our last issue, we learn that the whole of the current required for lighting purposes at this exhibition was supplied from the mains of the Chelsea Electricity Supply Co., Ltd., in accordance with arrangements which had been made many weeks previously.

Water-Power in Finland.—It is announced from St. Petersburg that at the instance of the Electric Lighting Co., of 1886, of St. Petersburg, a Viborg firm has acquired extensive land and water utilisation rights in connection with the rapids of the river Vuozen, Finland, which form the so-called little Imtra falls. The company proposes to prepare a hydro-electric scheme for execution in the near future, and the use of the most important of the Finnish water powers therefore seems to have advanced a stage towards realisation. It is calculated that the minimum power to be utilised will amount to from 50,000 to 60,000 H.P., which can be considerably increased if required, except during occasional periods of low water. It is expected that a portion of the power will be employed in Finland, although the major portion will presumably be transmitted to St. Petersburg, where the company already supplies from steam power stations a considerable quantity of electrical energy to industrial establishments, in addition to the ordinary lighting service. The use of the Imtra falls, which now pass into the possession of a financially strong company, has been under consideration for a long time past, and the prospective hydro-electric works is regarded as being of special importance to St. Petersburg, inasmuch as the scheme seems destined to render the company partly independent of foreign supplies of coal brought by sea transport, the delivery of which might be interrupted at any time in the case of strikes or international complications.

Improvement of Power Factors by Synchronous Motors.—An interesting practical paper on this subject was recently presented to the Atlanta Section of the Am.I.E.E. by Mr. H. E. Bussey. As is well known, the effective rating of every part of an A.C. generating and distributing system is reduced when a load of low power factor has to be supplied. The increasing use of induction motors for industrial power purposes has rendered the maintenance of a reasonable overall power factor in supply systems a problem of great importance, and, in America in particular, active measures have been taken to encourage the use of synchronous motors where possible. These machines require a direct-current excitation supply, and need more skill in manipulation than induction motors, but wherever their characteristics will meet the power requirements, synchronous motors should be employed. Not only does a synchronous motor not draw idle magnetising current from the A.C. mains, but also, by its regulable D.C. excitation, it is enabled to supply magnetising current to inductive apparatus on the same lines. It is quite an economical proposition to install synchronous machines running light and over-excited for the sole purpose of improving the power factor, in which case the machine is usually termed a synchronous condenser to distinguish it from a synchronous motor, which, in addition to providing a leading wattless current, is also carrying a mechanical load. The cost of the synchronous condenser is about £1·20 per K.V.A., as against £2·00 per K.V.A. for the motor.

As an example of the evil effects of low power factor, suppose it be required to deliver 1,000 KW. at a pressure of 6,000 volts three-phase, over a distance of 5 miles with a 10 per cent. energy loss. The requisite section of each line would be 79,200 cm. at unity power factor; 97,533 cm. at 90 per cent. power factor; and 218,000 cm. at 60 per cent. power factor—*i.e.*, the copper investment would be 2·8 times as great in the last as in the first case. If the same line were used (giving 10 per cent. loss at 100 per cent. power factor), the loss would be 28 per cent. at 60 per cent. power factor. A transformer giving 1 per cent. voltage regulation at 100 per cent. power factor will have about 3 per cent. regulation at 70 per cent. power factor, and in generating plant, the effect of low power factor is to decrease the rating of the generator as compared with its prime mover. If the power-factor of the load on the station busbars be 71 per cent., and if the K.V.A. of synchronous condenser capacity which must be floated on the line to raise the net power factor to 100 per cent. (thus increasing the available generator capacity by 29 per cent.), be denoted by 100—then 20 per cent. of this amount will add 11·5 per cent. to the effective generator capacity; 50 per cent. will add 22·5 per cent.; and 90 per cent. will add 28·7 per cent. Clearly, it is hardly economical to raise the power factor above 90-95 per cent.—requiring 40-60 per cent. of the synchronous K.V.A. needed to raise the power factor to unity. In order to improve the power factor of a distribution line (thus increasing its transmission capacity). synchronous condensers must be floated across the far end of the line.

In a particular case, a 24-hour induction motor load was carried at the end of a 10-mile line and two 1,650-K.V.A. synchronous condensers were installed. The power factor and load conditions under various circumstances are as follows:—

	P.F. of feeder and load.	Station end of feeder. KW.	Volts.	L.T.-bus at works. KW.	Volts.
Condensers out of use ...	0·74	9,100	2,200	5,800	450
Condensers taking full load amps. from L.T. bus at works	0·917	6,400	2,200	6,150	475
Condensers 25 % overload...	0·934	6,400	2,200	6,050	485

Appointments Vacant.—Borough electrical engineer for Limerick (£200; a knowledge of Irish language and history will be considered an additional qualification); chief assistant electrical engineer, for the Watford U.D.C. (£140); mains assistant for the City Electricity Department, Carlisle (35s. to 40s.); engineer-in-charge for the Newport Borough Electricity and Tramways Department (£2). See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—It is recommended that the salary of MR. P. P. WHEELWRIGHT, the engineer and manager of the Blackburn Electricity Works, be increased from £500 by annual increments of £50 up to £700.

The Hampstead Borough Council has, on the recommendation of the Finance Committee, granted MR. G. H. COTTAM a superannuation allowance by retaining his services as consulting engineer at 200 guineas per annum. The motion was passed by 19 votes to 13. The Council has appointed MR. H. H. COUZENS, of West Ham, to the office of chief engineer recently advertised, at £750 per annum plus a bonus of 2 per cent. on the net surplus in excess of £4,500.

The Harrogate T.C. has increased the salary of MR. NEIL MCLEAN, chief assistant to the electrical engineer, to a maximum of £230, by two annual increments of £10.

The Tramways Committee of the Dudley Corporation has increased the salary of MR. GEO. SAVAGE, the electrical engineer, from £250 to £275.

The Grays U.D.C. has increased the salary of MR. E. D. LONG, electrical engineer, by £25 a year.

The Heckmondwike U.D.C. has increased the salary of the chief engineer at the Electricity Works (MR. G. H. CARVER), by £10 per annum.

MR. W. HOLMES has been appointed acting electrical engineer and tramways manager to the Barking undertaking in place of Mr. H. L. Howard resigned, for a period of six months, at a salary of £200 per annum.

At Hampstead, London, on Tuesday, the marriage took place of MR. HAROLD GRAY, borough electrical engineer of Accrington, and Miss Dinsdale, of St. Annes. Mr. Gray was the recipient of a handsome silver tray as a wedding present from the Corporation officials and members of the Accrington Town Council.

Tramway Officials.—The Ilford U.D.C. has decided to appoint a tramways manager at a salary of £400 a year, rising annually by £20 to a maximum of £500.

MR. V. A. BELLAMY, third son of Mr. C. R. Bellamy, late general manager of the Liverpool Corporation tramways, has been appointed junior assistant engineer to the Manx Electric Railway Co. There were over 50 applicants.

General.—Our Indian correspondent sends us the following news:—"MR. H. H. REYNOLDS, M.I.E.E., consulting engineer, Calcutta, has gone to England on urgent private business; he is expected back at Calcutta in three months. MR. H. SPEYER, A.M.I.E.E., consulting engineer, has gone to Europe for a holiday. MR. J. W. MEARES, electrical adviser to Government of India, has left for Simla and the new capital; his headquarters will no longer be Calcutta. MR. A. K. TAYLOR, A.M.I.C.E., executive engineer, Electrical Division, Calcutta, has gone to England for a holiday. MR. G. MALLETT, electrical engineer to the Amir, has just returned from England, and resumed his State duties in Kabul."

MR. W. H. BIGGS, secretary for the Adams Manufacturing Co., Ltd., has accepted an appointment with Electromotors, Ltd., of Openshaw, Manchester.

MR. P. H. SYMONDS, who has been representing the steam side of the Brush Electrical Engineering Co., Ltd., at their London office, will in future make his headquarters at Loughborough.

MR. W. R. HARDING, A.C.G.I., and MR. C. G. BARKER, A.C.G.I., sailed on Saturday, the 25th ult., to Buenos Ayres to take up positions with the United River Plate Telephone Co. Mr. Harding has been appointed assistant engineer-in-chief and Mr. Barker assistant engineer. Both gentlemen were students of the Central Technical College from 1904 to 1907, and gained the College Diploma in the latter year. Since 1907 they have been on the engineering staff of the National Telephone Co.

NEW COMPANIES REGISTERED.

Electrical and Industrial Investment Co., Ltd. (122,256)—Registered May 29th, by Sydney Morse, 1, Kingsway, W.C. Capital £40,000 in £1 shares (200,000 6 per cent. cumulative preference). Objects: To carry on business as bankers, capitalists, financiers, concessionaires and merchants; to raise money by the issue of shares, to invest the money so raised in the purchase of, or otherwise, to acquire and hold any shares, stocks, debentures, debenture stocks, bonds, scrip, obligations, and securities, issued or guaranteed by any company constituted or carrying on business in the United Kingdom or elsewhere, and to adopt an agreement with the City of Birmingham Tramways Co., Ltd., and H. W. Brettell and T. Bower (the liquidators thereof), for the acquisition of the whole of the property of such company. The signatories are:—Emile Garcke, M.I.E.E., 1, Kingsway, W.C., 500 shares; C. G. Tegetmeier, Normanhurst, Brighton Road, Purley, director, 1 share; J. A. Christie, Sunbury House, Watford, Herts., bank director, 500 shares; G. C. Cunningham, M.I.C.E., 37, Craven Hill Gardens, W., consulting engineer, 500 shares; C. S. B. Hilton, 1, Kingsway, W.C., gentleman, 500 shares; R. B. Kingsford, 1, Kingsway, W.C., secretary, 500 shares: C. H. Dade, 1, Kingsway, W.C., secretary, British Electric Traction Co., Ltd., 1 share. Minimum cash subscription 5 per cent. of the share capital offered to the public. The first directors (to number not less than three or more than six) are:—Emile Garcke, M.I.E.E., J. A. Christie, G. C. Cunningham, M.I.C.E., C. S. B. Hilton, and R. B. Kingsford; qualification, £500; remuneration, £1,500 per annum, divisible. Registered offices, Electrical Federation Offices, 1, Kingsway, W.C.

Tampico Electric Light, Power and Traction, Ltd. (122,229).—Registered May 24th, by Thomas Cooper & Co., 21, Leadenhall Street, E.C. Capital, £250,000 in £1 shares. Objects: To acquire, by means of apportionment or otherwise, the undertakings and assets of the Compania de Los Ferrocarriles Urbanos de Tampico, South America, and the Compania de Fuerza Electrica de Tampico, South America, and the concessions held by J. and F. Borde for the supply of electric light and power at Tampico, Mexico, and to carry on the business of suppliers of electricity for light, heat, motive power, telephonic, telegraphic, industrial or other purposes, &c. The subscribers (with one share each) are:—G. Hutchins, 62, Flanders Road, Bedford Park, W., private secretary; W. M. Jackson, 32, Willow Road, Hampstead, N.W., secretary; A. Cotts, Heatherbrae, Harpenden, Herts, secretary; E. C. Wilson, 4, Exeter Mansions, Brondesbury, N.W., accountant; J. Baker, 53, Seward Road, Hanwell, W., clerk; H. J. Butchart, 40, South Grove, Highgate, N., accountant; E. J. Newman, 96, Old Road (West), Gravesend, assistant secretary. Minimum cash subscription, seven shares; the first directors (to number not less than three or more than seven) are to be appointed by the signatories; qualification, £500; remuneration as fixed by the company. Registered office, 47, Parliament Street, Westminster.

Optalyte, Ltd. (122,301).—This company was registered on May 30th, with a capital of £5,000 in £1 shares, to acquire patents relating to electric and other lamps and lenses, reflectors and accessories for use therewith, &c. The subscribers are:—F. Granger, Maryland Court, Maryland, Essex, gentleman, 100 shares; T. B. Dickinson, 6, Dudley Mansions, Abbey Road, N.W., member of Stock Exchange, 100 shares; S. F. Rumball, The Elms, Leighton Buzzard, stockbroker, 100 shares; F. P. Baxter, 13, Sise Lane, E.C., accountant, 25 shares; J. A. T. Good, 181, Queen Victoria Street, E.C., solicitor, 1 share; J. M. Kent, 4, Dalrington Road, Tooting, S.W., clerk, 1 share; F. Hall, 181, Queen Victoria Street, E.C., managing clerk, 1 share. Minimum cash subscription, 1,000 shares. The number of directors is not to be less than two or more than five; the first are F. Granger and T. B. Dickinson; qualification, £100; remuneration, £50 each per annum (chairman, £100), and a percentage of the profits. Registered by Good, Good & Co., 181, Queen Victoria Street, E.C.

Variable Speed Gear, Ltd. (122,304).—Registered May 30th, by Sugden and Hextall, 36, King Street, E.C. Capital £75,000 in £1 shares. Objects: To carry on the business of manufacturers of, and dealers in, machinery, plant and apparatus, suppliers of motive or mechanical power or force of any kind and for any purpose, &c., and to adopt an agreement between Universal Transmission, Ltd., of the first part, E. Marshall Fox of the second part, and the company of the third part, for the purchase of the British patents for the Williams Janney inventions for improvements in power transmission devices. The signatories (with one share each) are:—Sir V. Caillard, Kt., Vickers House, Broadway, Westminster, S.W.; F. C. Vickers, Vickers House, Broadway, Westminster, S.W., gentleman. Private company. The first directors (to number not less than two or more than six) are Sir V. Caillard and F. C. Vickers. Registered office, Broadway Court, Wesminster, S.W.

W. A. Meadows & Co., Ltd. (122,280).—This company was registered on May 29th, with a capital of £1,000 in £1 shares, to take over the business of an electrical and mechanical engineer, manufacturer of and dealer in electric, magnetic, telegraphic, telephonic and other appliances and apparatus carried on by W. A. Meadows at Percy Street, Hanley, Staffs., as "W. A. Meadows & Co." The subscribers (with one share each) are:—J. Boulton, Lorelli, Silverdale Road, Wolstanton, earthenware manufacturer; W. A. Meadows, Glenwood, Stockton Brook, Staffs., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. Boulton and W. A. Meadows (both permanent); qualification, 1 ordinary share; remuneration as fixed by the company. Registered office: Free Trade Buildings, Percy Street, Hanley, Staffs.

Anglo-Swedish Electric Welding Co., Ltd. (122,194).—This company was registered on May 24th, with a capital of £15,000 in £1 shares, to carry on the business indicated by the title, and to adopt an agreement between Elektriska Svetsnings Aktiebolaget and J. B. Hamilton (for the company). The subscribers (with one share each) are:—J. H. Rosenthal, Oriel House, Farringdon Street, E.C., engineer; O. Kjellberg, Partille, Sweden, engineer. Private company. The number of directors is not to be less than three or more than seven; the first are J. H. Rosenthal, G. W. Partridge, T. M. Aitken, B.Sc., E. H. N. Moxon, J. B. Hamilton (managing director), and O. Kjellberg; qualification, £200; remuneration according to profits. Registered by Geare and Willis, 51, Lincoln's Inn Fields, W.C.

Isaria, Ltd. (122,294).—This company was registered on May 30th, with a capital of £5,000 in £1 shares, to carry on the business of electrical and general engineers, suppliers of electricity, &c. The subscribers (with one share each) are:—D. Kimber, 3-4, Great Winchester Street, E.C., managing clerk; W. A. Adams, 11, Western Broadway, Hammersmith, W., clerk. Private company. The number of directors is not to be less than two or more than 10; the subscribers are to appoint the first. Registered office, 208, Tower Bridge Road, S.E.

CITY NOTES.

German Electrical Companies.

THE Elektrizitäts Ges. vorm. W. Lahmeyer & Co., Frankfort-on-Main, after deducting interest on loans, general expenses and providing for depreciation of the company's own supply works, reports net profits of £70,000 for 1910-11, as compared with £65,000 in the previous year. It is proposed to distribute 5 per cent. as against 4 per cent. in 1909-10.

The Ges. Fur Stickstoffdunger, of Knapsack, which was formerly known as the German Carbide Co., reports net profits of £870, for 1911, after making provision for depreciation to the amount of £11,900, as compared with £11,500 in 1910. This result compares with a loss of £9,300 in the previous year, which was extinguished together with the deficiency from 1909 by reducing the share capital. During 1911 the company produced 2,107 tons of nitrogen, which were disposed of in the form of nitrogen of lime and sulphate of ammonia. The proceeds from the carbide branch were unsatisfactory owing to the operation of old contracts at low prices, but improved prices are in force for the current year.

The financial results of the A.G. Mix und Genest, of Berlin, in 1911, were unfavourably affected by strikes and losses on investments. According to the accounts, the working surplus amounted to £47,000, as compared with £58,000 in 1910, and £60,000 in 1909. After meeting general expenses, and providing £15,000 for depreciation, as against a similar sum in 1910, there remain net profits and balance forward of £6,500. This amount has been carried forward, and compares with a dividend of 3 per cent. on share capital of £350,000 in 1910. The directors' report states that the lock-out of the metal workers affected the company, whose

inland departments were satisfactorily employed in general. In the telephone branch prices remained unprofitable; foreign markets were lost owing to high import duties, and politics also caused injury. The French subsidiary company in particular was unable to get into the business, and was compelled to liquidate, the Berlin company having thereby incurred a loss of £7,400. The English branch also resulted in a loss; preparations had been made for large orders arising from the nationalisation of the British telephone service, but they failed to make their appearance. The turnover in the new financial year, and the stock of orders, have so far been considerably greater than in the corresponding period in 1911.

The Deutsche-Ueberseeische Elektrizitäts Gesellschaft, of Berlin, which is the greatest German undertaking abroad as a supply authority and investment enterprise in South America, realised gross profits of £1,203,000 in 1911, as compared with £1,084,000 in the preceding year. After deducting general expenses in Berlin, taxes and insurance, interest on loans, and allocating £272,000 to depreciation, as against £221,000 in 1910, the accounts indicate net profits and balance forward of £526,000, as contrasted with £493,000 in 1910. It is proposed to pay a dividend of 10 per cent. on the share capital of £4,750,000 entitled to participate, this comparing with 10 per cent. on £4,500,000 in 1910, and 10 per cent. on £3,800,000 in 1909. The chief sphere of the company's activity is at Buenos Ayres, as is shown by the fact that the working surplus obtained there, the directors' report states, reached £1,011,000 in 1911, as against £890,000 in 1910 on a production of 193,350,009 KW.-hours and 161,700,000-KW. hours in the two years respectively. The development of the consumption was taking place by leaps and bounds, and the capacity of the six central stations was 74,760 KW., whilst extensions of 27,500 KW. would be brought into operation in 1912. It was also proposed to enlarge the Suddock station by the addition of plant of 7,500 KW. in order to comply with the concession for the extension of the public lighting by a further 4,000 arc lamps, and to supply power for the working of the future underground railway. The report refers to the working results of the other undertakings in which the company is also interested, as, for instance, the Moron electricity works, the Buenos Ayres and Quilmes tramway, the Compania Argentina de Electricidad, the Empresa de Luz y Fuerza of Mendoza, the Valparaiso electric tramway, the Trans-Atlantica tramway in Montevideo, and the Chilian Electric Tramway and Light Co., Ltd. As far as the last-named is concerned, it is mentioned that the company would distribute 6 per cent. on the preference shares for 1911, as was also the case in 1910, and that it would presumably also be able to pay an instalment on dividends in arrears. The share capital of the Deutsch-Ueberseeische Ges. has been raised to £6,000,000 in the present year, whilst the loan capital now stands at £4,223,000.

New General Traction Co., Ltd.

AN extraordinary general meeting of shareholders was held on Monday at Winchester House, E.C., Baron Emile d'Erlanger in the chair. The object of the meeting was to consider resolutions for reducing the capital from £370,000, divided into 50,000 6 per cent. cumulative preference shares of £5 each and 24,000 ordinary shares of £5 each, to £262,000, divided into 50,000 6 per cent. cumulative preference shares of £5 each and 24,000 ordinary shares of 10s. each, and that such reduction be effected by cancelling capital which has been lost or is unrepresented by available assets to the extent of £4 10s. in respect of each of the 24,000 ordinary shares of the company, and by reducing the nominal amount of each of such ordinary shares to 10s. Resolutions to this and the following effects were proposed by the CHAIRMAN:—

That on such reduction of capital taking effect every two fully-paid ordinary shares of 10s. each be consolidated into one fully-paid ordinary share of £1, and that the directors be, and they are hereby, authorised to issue fractional certificates, each representing half an ordinary share, so far as may be necessary, to carry this resolution into effect.

That on such reduction of capital taking effect, each of the 50,000 fully-paid preference shares of the company of £5 be sub-divided into five fully-paid preference shares of £1 each.

That on such reduction of capital taking effect the 250,000 preference shares of £1 each arising from such sub-division as aforesaid, and the 12,000 ordinary shares of £1 each arising from such reduction and consolidation be consolidated into one class consisting of 262,000 shares of £1 each, all ranking *pari passu* in respect of capital and dividends and right of voting.

The CHAIRMAN said the reason which had given rise to the meeting was the repurchase by the Corporation of Coventry of the tramway system there. They had been somewhat disappointed with the result of the arbitration, but they had agreed years ago when they took the concession, to go before an arbitrator to fix the value of the undertaking as a going concern when the Corporation intimated its desire to repurchase, and, therefore, they must accept the award without demur. The result of the arbitration had been to put a fairly large amount of money in their hands which would be utilised to pay off the prior lien debt and the floating debt, and to pay off a large portion of the 5 per cent. mortgage debentures. A situation had, therefore, been created which they had been long waiting for, to see how they could reorganise the finances of the company to the best advantage of the shareholders. It might have been thought that the wiser course to have pursued under the circumstances would have been to liquidate the company. Against that, however, there was a very potent reason, which was that their securities, which were small in number, were large in amount, and their realisation would, therefore, be a matter of considerable difficulty, and it was only by nursing them that they would be able to realise them at their intrinsic value. They had, therefore, to look upon the company as a holding company, and as the shareholders had for long been deprived of any return upon their capital, the board had to consider by what means they could make the earnings liquid, and available for future dividends. If they had allowed matters to stand as they were he was afraid that the period of paying dividends would not have arrived until their grandchildren became of age, because they had a debit of profit and loss of £22,000. They also had debentures amounting to about £8,000, and it was impossible to say that the securities which the company held were worth the price at which they stood in the books. They considered it necessary to write off £78,000 to bring down the value of those securities to their real and intrinsic value. They would therefore have to make good a loss out of earnings of £108,000 before they were able to divide any returns which they received on their securities. The only process by which this large amount could be written off was by obtaining from the Courts sanction for a reduction of capital. In a case where there were preference share-holders as well as ordinary it was only fair that the burden of the sacrifice should fall on the latter. On the other hand, it must be remembered that the consent of the Court to put through such a scheme could not be obtained without the consent of the ordinary shareholders, and, therefore, it was only fair that a certain amount of rights in the future of the company should be retained by the ordinary shareholders. The directors had endeavoured to find a scheme which would, as far as possible, be fair and just to both parties. The scheme entailed the loss by the ordinary shareholders of a sum of £108,000, so that out of the £220,000 ordinary share capital they would retain £12,000, which would rank *pari passu* with the capital of the preference shareholders, which was £250,000, so that the capital of the reorganised company would be £262,000. As a result of circularising 152 holders of preference shares 91 proxies had been received, representing 45,358 shares out of 50,000, in favour of the scheme. As far as the ordinary shareholders were concerned, there were 76 shareholders, and out of that number, 40, representing 20,133 shares out of 24,000, were present, either in person or proxy, to support the scheme. Such a result might almost be regarded as unanimous, seeing how the shares were spread, and how interest had been lost in the concern, owing to the non-payment of dividend for so many years. Some preference shareholders might think they were giving up their rights to cumulative dividends, but if they would consider the matter closely, they would see that they were only giving up 5 of 100 per cent. equity, they had in respect to accumulated dividends, because they retained 95 per cent. of the whole of all past rights, and all future profits. All they were giving up was 5 per cent. of future profits in allowing the ordinary shareholders to rank *pari passu* in respect of 5 per cent. of the capital.

The HON. A. BRAND seconded the resolutions, which were adopted unanimously.

Birmingham and Midland Tramways Co., Ltd.

THE directors report that in 1911 the total revenue from all sources was £109,901, compared with £102,613 in 1910. The expenses £52,365, compared with £53,700. After providing for all expenses chargeable to revenue, including repairs, maintenance, sums payable to corporations, and placing £5,000 to renewals account, there remains £52,535, plus £306 brought forward, making £52,841. After deducting interest on loans, £7,296, and interest on debenture stock, £14,953, there is a balance of £30,592. After deducting for debenture sinking fund £4,463, and dividend for the year on the 5½ per cent. preference shares £11,538, there remains £14,591. According to the *Financial News*, the directors recommend a dividend on the preferred ordinary shares at the rate of 3 per cent. for the year, £10,500; to depreciation and reserve account, £3,750; carried forward, £341. The gross receipts from the tramways were £50,515, compared with £48,025 in 1910. The gross receipts from the lighting and power departments amounted to £26,469, a decrease of £268. The dividends from investments produced £29,861, compared with £25,177 in 1910. The total expenditure on capital account during the year was £6,211. The total amount of debenture stock now outstanding is £329,893. The directors have carefully considered the offer received by the directors of the City of Birmingham Tramways Co., Ltd., and have come to the conclusion that they may anticipate a substantial increase in dividends as a result of the exchange of shares in the City of Birmingham Co. for securities of the new company. They have therefore signified their intention to take debenture stocks and shares in the new company on the terms proposed. The Birmingham and Midland Motor Omnibus Co. is now proposing to make a new issue of £30,000 5 per cent. debentures, redeemable out of profits, at 110 per cent. An offer has been received by the company to exchange its present holding of debentures for debentures of the new issue, subject to the company agreeing to subscribe for £6,800 additional new debentures. The company has consented to participate in the issue, subject to the other debenture-holders agreeing to the same terms.

Egypt.—The balance sheet of the Compagnie Egyptienne Thomson-Houston, for the last financial year, shows a profit of only £4,064, which is being carried forward to the current 12 months.

Richard Hornsby & Sons, Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

MR. ROGER WALLACE, K.C., chairman, presided on Friday last at Winchester House, E.C., over the sixth ordinary general meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 894), the CHAIRMAN said the profits for the year after deducting expenses in Kalgoorlie were £24,290, as against £18,106 last year, showing that they had made during the year a net profit in Kalgoorlie of more than £6,000 above the year 1910. This was very satisfactory, considering that they had had strikes and other things to meet during the period. They had decided to put £7,500 to reserve, and to make provision for the 2 per cent., premium payable on the redemption of the debentures. Under those conditions, of course, the first thing the shareholders would ask was why they did not propose to pay a dividend on the ordinary shares. They must remember, in the first instance, that the ordinary shares were not really capital shares, but they represented the deferred interest, which was profit to the promoters, and also certain interest which was not paid in the first few years of construction to the preference shareholders. Really the preference shares were the ordinary shares of the company, whilst the ordinary shares were really deferred shares. Therefore, they felt quite justified, under the circumstances which he would explain, not to pay a dividend on the ordinary shares. During the early portion of the year they had to submit to an event which they could not very well provide for. It was a cyclone, which blew down their cooling tower which unfortunately struck several of the lines communicating with the mines and stopped them for a few days. They were able to keep the tramways running. This mishap would involve an expenditure of about £3,000. Seeing that in that company they were liable to strikes and to breakdowns of machinery at a distance, they thought it advisable to keep money in hand so that they would not have to go to the bankers and borrow money to meet emergencies. Consequently they had made provision for the replacing of the part of the plant injured by the cyclone, and had made certain provision for new plant. Had it not been for the cyclone they certainly would have paid a dividend on the ordinary shares, but they would have to look forward to that next year. They had had the opportunity during the year of consulting with Mr. Crocker, their engineer, who had spent a long-deferred holiday in this country, and had taken the chance of seeing what improvements had been made in the electrical stations in this country. Mr. Crocker was of opinion that their plant was pretty well up to date, but he had confirmed the directors' view that their old Stewart engines, which had been used as a stand-by, would give more economical results if they also used a turbine, and consequently they had ordered a turbine which would not only use the steam, but also give them an independent unit. That would be paid for out of the revenue for the year. They also considered that by the installation of certain synchronising transformers they would get better results and store a great deal of energy now wasted in the cables. With these two alterations and certain other minor details the company's plant would be now quite up to date. They also had the best load factor in the world, which was due to the care of Mr. Crocker and his staff, and also to the direction on this side. The outlook was very promising, and so long as they could keep free of strikes he thought they would do very well. He should add that it was not strikes in their own works that they feared, but in the works of their consumers.

MR. E. POPE seconded the motion.

MR. MORGAN asked if the board had considered the question of using Diesel oil engines. He was a member of the Electricity Committee of a Corporation which had gone very carefully into the question and had decided to spend a considerable sum of money in the coming year on Diesel oil plant, and having had the figures before him he admitted frankly that he was astounded at the saving anticipated over steam. He did not know what the company paid for coal, but his Committee paid 12s. 6d. a ton. He hoped on another occasion to be able to say what the actual saving had been.

The CHAIRMAN said his first experience of Diesel engines went back 25 or 30 years, when he was asked by the Diesel Co. to go down and inspect their plant and machinery, and since then enormous improvements had taken place. They had always kept their eye on the question, but in all electrical stations they had to consider the conditions of the *locus in quo*. In Australia they had not even got coal and were obliged to use wood. If they could use oil it would undoubtedly be a great advantage to the company, but there was no oil, so far as he was aware, in Western Australia. He had been in communication for some time with the Shell Transport Co., and had talked the matter over with Sir Marcus Samuel with a view to getting a supply to Kalgoorlie, but they were a long way inland and railway freights were high, and it was quite impossible to use oil engines if the oil had to be transported in tanks. They would have to have a pipe line or something of that kind. There were also other matters, such as the temperature and the sand storms and so on to consider, but they did not overlook anything which was likely to benefit the company.

MR. CROSS asked how the reserve was employed, and pointed out that the present holders of the ordinary shares had paid a fair price for those shares, and were entitled to a dividend. He did not see why the board should have written off the debenture premium in one year. He asked why they did not have monthly reports, as they had no clue whatever as to the expenses of the company. Although the directors did their work well, yet £850 was rather heavy for fees. It seemed to him it was the intention of the board to use the reserve fund for the redemption of the debentures, which would be entirely at the expense of the ordinary shareholders.

The CHAIRMAN said the reserve was employed at present in purchasing the new plant, which was much more advantageous to them than by investing it outside the company. He agreed that people who bought the deferred shares did not look at the past, and wanted a dividend. It was not the intention of the board to disregard that view, or to build up a reserve fund to redeem the debentures. As to writing off the £1,200, the fact was they wanted the money, and they might as well write it off that item as anything else. It would make it easier for them to pay an ordinary dividend later. The directors did a lot of work, and no one would grudge them their fees. Returns came to the office every month, which shareholders were at liberty to see.

MR. L. BUTCHER criticised the figures in the balance sheet, and said the management expenses and office expenses were very high, whilst with regard to the engineer's fees, why could not they get an engineering shareholder to serve on the board?

The CHAIRMAN said that all the machinery which was sent out had to be tested, and they must have advising engineers.

MR. BUTCHER moved that the report be not adopted unless a dividend was paid on the ordinary shares.

MR. CROSS seconded the amendment.

Several shareholders endorsed the action taken by the board.

The amendment was defeated, and the report adopted, with one dissentient.

The retiring auditors and director were re-elected.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

Victoria Falls and Transvaal Power Co., Ltd.—Scrip, fully and partly paid, for £1,000,000 5½ per cent. second mortgage debentures, series "A."

And to allow the following securities to be quoted in the Official List :—

Companhia Ferro Carril do Jardim Botanico (Jardim Botanico Tramway Co.).—Further issue of £400,000 5 per cent. 40-year first mortgage bonds of £100 each, Nos. A8,001 to 12,000.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—Further issue of $250,000 general mortgage 4½ per cent. 30-year gold bonds of $1,000 each, Nos. 9,833 to 9,932 and 10,033 to 10,232.

Metropolitan District Railway.—Further issue of £150,000 4 per cent. prior lien debenture stock.

Ordered the undermentioned securities to be quoted in the Official List :—

Montreal Water and Power Co.—Further issue of £16,600 4½ per cent. first mortgage prior lien gold bonds of £1,000, Nos. 8,948 to 8,997 and 9,098 to 9,213.

An Indian Issue.—We observe from an Indian newspaper that the Lahore Electric Supply Co., Ltd., recently offered for subscription in India, Ordinary shares (Rs. 100 each) one lac and preferential participating shares (Rs. 100) two lacs. It was mentioned that the Local Government was prepared to guarantee a total demand of not less than 150,000 units per annum. One lac of ordinary shares had previously been subscribed and two lacs of first mortgage debentures. Lala Harkishen Lal is the chairman of the company, and the offices are at McLeod Road, Lahore.

Prospectus.—*Thomas Bolton & Sons, Ltd.*—This company last week issued a prospectus inviting subscriptions for £300,000 in 3,000 5 per cent. first mortgage debentures of £100 each at par. The proceeds were to be used to provide for the redemption of the existing debentures (£160,000 4½ per cent. first and £120,500 5½ per cent. second) and for the requirements of the company's business.

Traction and Power Securities Co., Ltd.—The report states that the profit and loss account for the year to December 31st, shows a credit balance of £29,810, plus £5,185 brought forward, giving a total sum of £34,996 to be dealt with. Out of this the directors have transferred £25,000 to the investment reserve account, leaving a balance of £9,996 to be carried forward. The investment reserve account now stands at £160,000.—*Financier.*

J. Stone & Co., Ltd.—The directors have declared a dividend of 10 per cent. and bonus of 1s. per share (together 3s. per share) on the ordinary shares for the year to December 31st; £5,000 is placed to reserve and £49,380 carried forward. The *Financier* states that the directors are considering the advisability of subdividing the preference £10 shares into preference £1 shares.

Hurst, Nelson & Co., Ltd.—Owing to the stoppage caused by the coal strike, the directors recently informed the preference shareholders that they preferred to wait until the accounts for the year are completed before resolving upon payment of the preference dividend now due

Victoria Falls Power Co., Ltd.—In regard to the paragraph published in our last issue, we understand that the preference dividend (6 per cent. per annum) there referred to as paid was for the period of nearly 15 months (from October 15th, 1909, to December 31st, 1910).

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended April 26th, 1912, amounted to 884,966, compared with 787,233 units in the corresponding four weeks of 1911.

Consolidated Gas, Electric Light and Power Co., of Baltimore.—The directors have declared a dividend of 1¼ per cent. on the common shares for the quarter to June 30th.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, June 5th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2¾d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16 10	..
a Copper Sulphate	„	£24 15	..
a Lead, Nitrate	„	£26 10	..
a „ White Sugar	„	£25 10	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70/72 %)	„	£10 5	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£8 5	..
a Sodium Bichromate, casks	per lb	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£70	..
b „ Wire, in ton lots	„	£102	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9d.	¼d. inc.
c „ Tube (brazed)	„	11¼d.	¼d. inc.
c „ „ (solid drawn)	„	9⅝d.	¼d. inc.
c „ Wire, basis	„	9d.	¼d. inc.
c Copper Tubes (brazed)	„	1/0½d.	¼d. inc.
c „ „ (solid drawn)	„	11½d.	¼d. inc.
g „ Bars (best selected)	per ton	£94	£4 inc.
g „ Sheet	„	£94	£4 inc.
g „ Rod	„	£94	£4 inc.
d „ (Electrolytic) Bars	„	£79 5	£2 15s. inc.
d „ „ Sheets	„	£96 5	£2 15s. inc.
d „ „ Rods	„	£84 5	£2 15s. inc.
d „ „ H.C. Wire	per lb.	10d.	¼d. inc.
f Ebonite Rod	„	5/3	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/11	..
b Gutta-percha, fine	„	..	..
b India-rubber, Para fine	„	4/7½	..
l Iron Pig (Cleveland warrants)	per ton	53/8	3½d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£17 10s.	15/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 5	..
c Mica (in original cases) small	per lb.	6d. to 8s.	..
c „ „ „ medium	„	8/6 to 6/-	..
c „ „ „ large	„	7/6 to 11/-	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/0½	..
p „ „ rolled strip & sheet	„	1/1	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£203 to £205	£6 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£29 15	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

It cannot be said that Stock Exchange markets are in any particularly happy frame of mind. Though the mid-May settlement passed off with the disclosure of much less trouble than had been anticipated, the knowledge remains that weak accounts abound in several directions, and these will weigh upon prices until the public mood changes from caution to a more speculative feeling. Not a few members of the Stock Exchange look for the quietude to last during the summer months, and if this estimate is correct, there is not very much to go for at present.

The Home Railway market, after its severe shaking, pulled itself together and put a braver face upon its prices. The failure in the market was not unexpected, and it is thought that all the trouble is not yet over, various weak positions being known to exist. So far as prices are concerned, the principal recoveries have been in Metropolitans, Districts and City and South London, while Central London issues have improved substantially. Metropolitans, which were down 5¾ last week, have rallied to the extent of 4 points. Districts, after their drop of 3, also rose 4. City and South London, which lost 4 last week, recovered its decline. Central London Ordinary and Deferred each regained 3 points of their 4-point losses, but the company's 4 per cent. Preferred stock is still weak at 85 middle, at which the yield is the substantial one for this class of security of 4¾ per cent., allowing for the accrued dividend in the price. Underground Electrics started to recover, the company's shares and Income Bonds both rallying smartly. The 1s. "A" shares are 16s. middle. London United Tramways Preference regained 10s. in sympathy with London transport issues generally. British Electric Tractions continue a dull market, although the only quotable change is a fall of a point in the 5 per cent. Perpetual Debenture stock.

Amongst English Electricity shares, County of Londons are hardening up again, and the Ordinary is up to 11 once more, while the Preference show ⅛ rise. Cities are quiet. The Ordinary shares, moving fairly freely, are nominally unchanged at 21, but the Preference went back another 10s. There is a scarcity of Bournemouth and Poole Ordinary, and although the official price is 9½-10½, sellers have been able to obtain as much as 10½ this week. The list, as a whole, is steady, without any particular feature, liquidation in other parts of the House passing over this department and leaving it almost unscathed.

The feature in the Latin-Canadian group is the levelling up of prices of many of the bonds on to the basis of five dollars to the sovereign. On several occasions attention has been drawn here to the fact that in certain instances these bonds have been quoted on the basis of £102 14s. 10d. for the $500 bond, but by a sensible rule the Stock Exchange ordered that from Saturday last all these exceptions should be quoted at the "flat" rate of 4s. per dollar. In consequence, a number of prices have been nominally raised, although the actual difference is nothing at all—a consideration entirely lost upon quite a number of estimable newspapers which commented upon the manner in which the prices of these bonds rose last Saturday. It is a good thing to have them all quoted in the same way, and it will render the market more popular than ever.

Sao Paulo Trams continue their monotonous rise, and after touching 260, reverted to 252½, showing a gain of 8 points on the week. Mexican Light and Power Common shares have come into favour again, picking up their 2-point loss of a week ago. Mexico Trams put on 2, the progress of the revolution being regarded here as not unlike that of the silly strike of lightermen on the Thames. Rio Trams, supported largely by Continental buying, rose 4½ points on top of their big advance of last week, the company's receipts for April being extremely good. The net earnings of £129,905 show an increase of £23,305. The rest of the changes in this section are caused mainly by the alteration in the manner of quotation just referred to.

Steady buying of Anglo-Argentine Tramways accounts for further rises in the prices of both Preference shares, while the 4 per cent. Debenture has crept up to within three or four points of par. Brisbane Trams have been put back to 7¾, but this *ex* everything—viz., 4s. dividend and bonuses of 20s. net in ordinary shares, with fractions in cash. Babcock & Wilcox shares, it may be mentioned here, are just halved in price by the deduction of the bonus, one new ordinary share having been given for every old Ordinary at present held. The capital being doubled, the yield on the shares, on the basis of the last dividend, works out to about 4¼ per cent.; but as the distribution will probably make a sensible difference to the dividend, it would be somewhat out of place to work out the return in the ordinary way, and for this reason we have taken out the yield figures in the columns which follow our quotations.

There is nothing much doing in Telegraph shares. Great Northerns have started to regain part of their recent severe fall, and there is a little better feeling in the Anglo-American group. Amazons are a shade harder, and so are Westerns. The dividend of 1s. per share has been deducted from West India and Panama Ordinary, the price of which has recovered smartly, leaving a rise of 6s. 3d. on the week—this helps to confirm the impression mentioned in this column that the price would be put better as soon as the weaker brethren had got rid of their shares. Globes rose to 11¼ but Mackay Common shed 5 points upon American selling, although, curiously enough the Preferred shares are 1 higher. New York Telephone bonds went back a little on the new issue.

Buying has been resumed of National Telephone Deferred stock, the price of which showed a rise of 4½, but Liverpool selling knocked off part of this. There are still left speculators hardy enough to deal in this dangerous security, speculators who maintain that the price to be paid by the Government will be agreed at a figure that will show a handsome profit on purchases made at anything below 160. As to that, however, time alone can show.

In the manufacturing division, Edison & Swan "A" shares put on ½, making the middle price 15s. On the other hand, Telegraph Constructions are £1 lower, and India-Rubber shares lost 5s. There is not much doing as a whole, and so far as the rubber market is concerned, dealings have again shrunk to a mere nothing.

Sao Paulo Tramway, Light and Power Co.—The directors have declared a quarterly dividend at the rate of 10 per cent. per annum.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 4th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5⅓	5⅓	9¼ — 10¼	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	9¼ — 9½	..	4 12 2
Do. Second 6 % Pref. ..	10	6	6	10¼ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	100 —102	..	4 8 3
Brompton & Kensington, Ord...	5	10	10†	8¼ — 8⅝	..	5 14 3
Do. 7 % Cum. Pref.	5	7	7	7⅛ — 8⅛	..	4 6 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100 xd	..	4 0 0
Charing Cross, West End & City	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8¼ — 4⅜	..	5 2 10
Do. % Deb... ..	100	4	4	95 — 98	..	4 1 8
Chelsea, Ord.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	8	20 — 22	..	3 12 9
Do. 6 % Cum. Pref.	10	6	6	16 — 18	— ½	3 6 8
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb. ..	100	4½	4½	101 —104	..	4 6 7
County of London, Ord... ..	10	5	6	10⅜ — 11½	+ ⅛	5 7 0
Do. 6 % Pref.	10	6	6	11⅜ — 11⅝	+ ⅛	5 1 1
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 —103	+1	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅛ — ¾	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 — 8¼	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4½ — 4⅝	..	5 5 8
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 13 9
Hove	5	9	9	6⅞ — 7⅛	+ ⅛	6 4 2
Kensington & Knightsbridge, Ord	5	9	9	7⅛ — 7⅜	..	5 16 2
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	80 — 84	..	5 7 3
London Electric, Ord.	8	2	2½	1⅜ — 2	..	3 15 0
Do. 6 % Pref.	5	6	6	4⅛ — 5⅛	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	92 — 95	..	4 4 3
Metropolitan	5	5	4	3⅝ — 4⅛	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 14 9
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	101 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	85 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96 — 98	..	4 11 10
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅛ — 5	..	5 0 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	97 —100	..	5 0 ·
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10⅛ — 11½	..	5 6 8
Oxford	5	7½	7½	5⅞ — 6⅛	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8 — 8⅜	..	5 14 3
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	..	4 15 0
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord. ..	5	Nil	2	1⅜ — 1½	..	..
South London, Ord.	4	5	5	2⅜ — 2½	..	6 8 0
Do. 5 % First Mort. Deb. ..	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref...	1	7	7	1⅜ — 1⅝	..	6 1 0
Do. 4½ % First Deb. Stock ..	100	4½	4½	98 — 99	..	4 11 0
Urban, Ord...	5	5	..	⅜ — ½	..	..
Do. 5 % Cum. Pref.	5	5	2	2½ — 3 xd	— ⅛	3 6 8
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8½ — 9	..	5 11 1
Do. 4½ % Cum. Pref.	5	4½	4½	5⅛ — 5⅜	..	4 4 8

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅝ — 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	8½	7⅛ — 7⅜	..	5 9 8
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	96½ — 98½	+1	5 9 3
Canadian Gen. El. Com. ..	$100	7	7†	112 —116	..	6 0 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	3†	⅛ — ⅛	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	95½ — 97½	..	6 3 1
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95 — 97	..	5 3 1
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅞ — 1	..	Nil
Do. 6 % Pref.	1	6	6	3⅜ — 3½	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	106 —108	..	4 12 7
Madras, Ord.	5	..	..	2½ — 2⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	104 —107	..	4 13 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	90½ — 92½	..	5 8 1
Mexican Lt. & Power, Common	$100	4	4	91 — 93	+2	4 6 0
Do. 7 % Cum. Pref.	$100	7	7	105 —107	+1	6 10 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96 — 98	..	5 2 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Montreal, Lt., H. and Power ..	$100	7	8	211 —215	..	3 14 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	89 — 42	+ ½	11 18 2
River Plate, Ord.	Stock	10	10	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	109 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	103 —105	..	4 15 3
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital ..	$100	4	5†	140 —144	..	3 9 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	111½ —113½	..	4 8 1
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	+ ½	4 5 9
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	100½ —102½	..	4 7 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	99½ — 94½	..	5 5 10
Victoria Falls Power, Pref. ..	1	Nil	11¾d.	⅞ — ⅞	+1/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½ —107½	..	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7⅛ — 7⅜	+ ⅛	..
Do. 5 % Deb. Red.	Stock	5	5	97½ — 99⅜	..	5 0 6
American Telep. & Teleg., Cap.	$100	8	8†	148 —150	..	5 6 8
Do. Collat. Trust	$1000	4	4	96⅛ — 97⅛	+ ⅛	4 2 1
Anglo-American Telegraph ..	Stock	3⅞	3	66 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	108⅜ —109½	+ ⅜	5 9 7
Do. Def...	Do.	80/-	80/-	25½ — 26	+ ⅛	5 15 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	..	7⅞ — 8	..	4 10 4
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	88 — 85	+ ⅛	4 14 2
Cuba Telegraph	10	6	6†	9½ — 10½	..	5 14 3
Do. 10 % Pref...	10	10	10	16½ — 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref... ..	5	10	10	7⅛ — 7⅜	..	6 9 0
Direct United States Cable ..	10	4½	5	7⅛ — 8	..	5 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	5†	131—134 ex all	..	5 4 6
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	78 — 81 xd	—1	4 6 5
Do. 4 % Mort. Deb.	Do.	4	4	99½ —101½	..	3 18 10
Eastern Extension	10	7	5†	12⅜ — 13½	..	5 5 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97 —100	..	4 0 0
Globe Telegraph and Trust ..	10	5⅞	6†	11 — 11½	+ ⅛	5 4 4
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 9 0
Great Northern Telegraph ..	10	18	18	29½ — 30½	+ ½	5 18 10
Indo-European Telegraph ..	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common ..	$100	5	5†	82 — 85	—5	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	+1	5 9 7
Marconi's Wireless Telegraph	1	5	..	6⅜ — 6½	+1	..
Do. 7 % Cum. Partic. Pref.	1	16	..	5⅞ — 6	+1	..
Monte Video Telephone, Ord. ..	1	6	6	1 — 1⅛	..	5 6 3
Do. 5 % Pref.	1	5	5	⅞ — 1	—1/32	5 14 3
National Telephone, Pref. ..	Stock	6	6	100 —103	..	..
Do. Def.	Do.	6	6	151½ —153½	+1	..
Do. 5 % Non-cum. 3rd Pref.	5	5	5	6⅜ — 6⅝	+ 1/16	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99 —100	— 1/16	4 10 0
Oriental Telep. and Elec. ..	1	8	8	14½ — 15⅜	..	4 13 0
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	89 — 91	..	4 8 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½ —101½	..	3 18 10
Reuter's	8	5	5†	11 — 11½	..	3 9 7
Submarine Cables Trust ..	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7⅜ — 7½	..	5 1 7
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 8 11
West Coast of America	2½	2½	2½	1⅝ — 1⅞	+ 1/16	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94½ — 97½	..	4 2 1
West India and Panama Teleg.	10	1½	1½	2⅛ — 2⅜	+ 1/16	3 18 2
Do. 6 % Cum. 1st Pref. ..	10	6	6	10⅜ — 10⅝ xd	..	5 13 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅜ — 10 xd	..	6 0 0
Do. 5 % Debs.	100	5	5	102½ —104½	..	4 15 8
Western Telegraph, Ltd. ..	10	7	6†	18⅛ — 18⅜	+ ⅛	5 1 10
Do. 4 % Deb.	Stock	4	4	98 —100	..	4 0 0
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 4th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅞ — 1	..	Nil
Do. 5 % Pref.	1	5	5	1/16 — 3/16	..	6 3 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref.	100	..	..	10½ — 12½	..	..
Do. Do. Deferred	100	..	..	6½ — 8½	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	92 — 94	..	6 7 8
Do. 7 % Non-Cum. Pr'f.	100	..	..	44 — 48	..	..
Do. 5 % Perp. Deb.	100	5	5	98 — 97	..	5 3 1
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 83	..	5 8 5
Central London Railway, Ord.	100	3	3	80 — 82	+3	3 13 2
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	80 — 82	+3	2 8 9
Do. 4 % Deb.	100	4	4	101 — 103	..	3 17 8
City & South London, Ord.	100	1½	1⅝	87 — 88	+¼	4 5 6
Do. 5 % Pref., 1891	100	5	5	108 — 110	..	4 11 0
Do. Do. 1896	100	5	5	104 — 106	..	4 15 3
Do. Do. 1901	100	5	5	104 — 106	..	4 14 4
Do. Do. 1908	100	5	5	103 — 105	..	4 15 3
Do. 4 % Deb.	100	4	4	99 — 101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10⅞ — 11⅛	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅜ — 1⅝	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	6	⅜ — ⅝	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅜	..	4 11 0
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	83 — 85	..	5 17 8
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	5⅛ — 5⅜	+ ⅛	..
Do. 4 % Deb.	100	4	4	77 — 80	—1	5 0 0
Metropolitan Railway Consol.	100	1⅜	1⅞	66¼ — 66⅞	+4	2 16 0
Do. Surplus Lands	100	2⅜	2⅞	66 — 68	..	4 4 7
Do. 3½ % Deb.	100	3½	3½	89 — 91	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	87 — 89	..	3 18 8
Metropolitan District Ord.	100	Nil	..	44 — 44½	+4	Nil
Do. 6 % Deb.	100	6	6	144 — 146	..	4 2 2
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	99 — 101	..	3 19 3
Do. 4½ % First Pref.	100	3⅞	4½	90 — 92	..	4 17 10
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5½	6	1⅜ — 1	..	6 0 0
Do. Def.	1	Nil	..	1/16 — 3/16	..	Nil
Do. 5 % Pref.	1	5	5	25/32 — 27/32	..	5 10 6
Do. 4½ % Deb.	100	4½	4½	98 — 100	..	4 10 0
Do. 5 % Deb.	100	5	5	98 — 100	..	5 0 0
Potteries, Ord.	1	2	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	1/2 — 3/4	..	6 18 4
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	1⅛ — 1⅜ xd	..	7 7 8
Do. 4 % Deb.	100	4	4	72 — 77	..	5 4 0
Underground Elec. Railways	10	..	..	4⅛ — 4⅜	+ ⅛	Nil
Do. 4½ % Bonds	100	4½	4½	99 — 101	..	4 9 1
Do. 6 % Income	100	1	1½†	90 — 92	+2	..
Yorkshire (West Riding), Ord.	5	Nil	..	⅛ — ⅜	..	Nil
Do. 6 % Pref.	5	Nil	..	2⅛ — 3½	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½	5⅜ — 5⅝	+ 1/16	4 18 10
Do. 2nd Pref.	5	5	5½	5 — 5¼	+ 1/16	5 4 9
Do. 4 % Deb.	100	4	4	95½ — 97	+ ½	4 2 6
Do. 4½ % Deb.	100	4½	4½	101⅛ — 103½	— ½	4 7 0
Do. 5 % Deb.	100	5	5	102 — 104 xd	..	4 16 2
Auckland Trams, 5 % Deb.	100	5	5	104 — 106	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11⅛ — 11⅝	..	5 3 3
Do. 4½ % Deb.	100	4½	4½	98 — 100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	99 — 101	..	4 19 0
Brisbane Trams Invs., Ord.	5	8	8	7⅛ — 7⅜ ex. all	..	..
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛ xd	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 — 103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	140 — 144	..	5 11 1
Do. Pref. Ord.	100	6	6	126 — 129	+1	4 13 0
Do. 5 % Pref.	100	5	5	111 — 114	..	4 7 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98½ — 101½	..	4 8 8
Do. 4½ % Vancouver Deb.	100	4½	4½	103 — 105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	104 — 106	..	4 5 0
Calcutta Trams, Ord.	5	6	7	6⅞ — 6⅞	..	5 5 8
Do. 5 % Pref.	5	5	5	4⅛ — 5⅛	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	100 — 103	..	4 7 5
Cape Electric Trams	1	Nil	2½†	⅜ — ½	..	..
City Buenos Aires Trams (1904)	5	5	5	5⅜ — 5⅝	..	4 10 6
Do. 4 % Deb.	100	5	5	101 — 103	..	4 17 3
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101 — 104	..	4 16 2
Kalgoorlie Elec. Trams	1	Nil	..	1/16 — 3/16	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94	..	5 6 5
Do. 6 % B Deb.	100	5	6†	56 — 60	..	10 0 0
La Plata Elec. Trms, Ord.	1	..	..	⅛ — 3/16	..	..
Do. Pref.	1	6	6	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Madras Elec. Tr. (1904), Deb.	100	5	5	100 — 102	..	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	93 — 96	..	5 4 2
Manila Elec. R. and Ltg., Bonds	$1000	5	5	102½ — 104½	..	4 15 8
Mexico Trams Com.	$100	7	7	123 — 125	+2	5 12 0
Do. Gen. Con. 5 % Bonds	..	5	5	98½ — 100½	..	4 19 6
Do. 6 % Bonds	100	6	6	103½ — 105⅝	..	5 13 9
Para Elec. Rlys. & Lt., Ord.	5	10	10	7 — 7⅜	..	6 15 7
Do. 6 % Pref.	5	6	6	5 — 5½	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	100 — 102	..	4 18 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1 1/16 — 1 1/16	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	101 — 104	..	4 16 2
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	99 — 101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	140½ — 142½	+4½	3 10 2
Do. 1st Mort. 5 % Bonds	..	5	5	106¼ — 107½	..	4 13 3
Do. 5 % Mort. Bonds	100	5	5	99 — 100	+ ¼	5 0 0
Sao Paulo Tram, Lt. and P.	$100	10	10†	250 — 255	+8	3 18 5
Do. 5 % 1st Deb.	$500	5	5	106 — 108 xd	+3	4 12 7
Singapore Trams, 5 % Deb.	100	5	5	79 — 82	..	5 19 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	+2	5 5 8
Un. Elec. Trams Monte Video	5	6	7	5½ — 6	..	6 1 11
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	100 — 103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104½ — 106½	+1½	4 4 6

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	1⅛ — 1⅜	..	7 7 8
Do. 5 % Pref.	1	9	6	4/32 — 5/32	..	7 2 2
Babcock & Wilcox	1	26	28	3⅞ — 3 7/32 xd	..	..
Do. Pref.	1	6	6	1⅜ — 1⅝	..	3 18 10
B.I. & Heisby Cables	5	10	10	7 — 7½	..	6 13 4
Do. Pref.	5	6	6	6 — 6½	..	4 12 4
Do. Deb.	100	4½	4½	101 — 103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	91½ — 94½	..	4 15 3
British Westinghouse, Pref.	3	Nil	..	1/32 — 3/32	..	Nil
Do. Deb.	100	4	4	63 — 66	..	6 1 3
Do. 6 % Prior Lien	100	6	6	100 — 103	..	5 16 6
Browett, Lindley, Ord.	1	Nil	..	1/6 — 2/-	..	Nil
Do. Pref.	1	Nil	..	5/- — 6/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ⅛	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	77⅞ — 82⅞	..	6 1 3
Do. 4½ % Deb.	100	4½	4½	54 — 59	..	7 10 6
Do. 4½ % Second Deb.	100	4½	4½	37 — 42	..	10 14 4
Callender's Cable	5	15	10†	10⅜ — 11½	..	6 10 5
Do. Pref.	5	5	5	5 — 5½	..	4 15 3
Do. Deb.	100	4½	4½	99½ — 101½	..	4 8 8
Castner-Kellner	1	17½	20	3⅞ — 3⅞ xd	..	5 10 2
Do. Deb.	100	4½	4½	105 — 109	..	4 10 7
Crompton & Co.	3	Nil	Nil	⅛ — ¼	..	Nil
Do. Deb.	100	5	5	58 — 68	..	7 7 1
Dick, Kerr	1	5	..	3⅞ — 3¼	..	5 8 1
Do. Pref.	1	6	6	1 1/16 — 1 1/16	..	5 12 11
Do. Deb.	100	4½	4½	97 — 100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	..	⅜ — ½	+ ⅛	Nil
Do. fully paid	5	Nil	..	1⅝ — 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Do. 5 % Second Deb.	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	Nil	2½†	¾ — 1	..	..
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7¾ — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9½	..	5 5 3
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11⅜ — 12⅛	..	6 0 0
Do. Pref.	5	4½	4½	4 1/16 — 5 3/16	..	4 6 9
Do. Deb.	100	4½	4½	101 — 103 xd	..	4 7 5
India-Rubber, G. & T.	10	10	..	8¼ — 9½	— ¼	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	20	10†	33 — 35	—1	6 19 5
Do. Deb.	100	4	4	99½ — 101½	..	4 9 0
Willans & Robinson	1	Nil	..	1/16 — 1/16	..	Nil
Do. Pref.	5	Nil	..	⅛ — 1	..	Nil
Do. Deb.	100	4	4	58 — 60 xd	+1	6 18 4

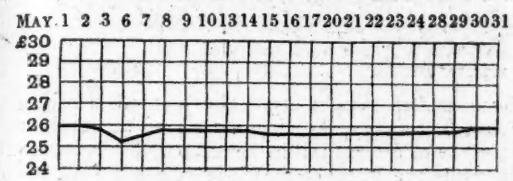
* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912

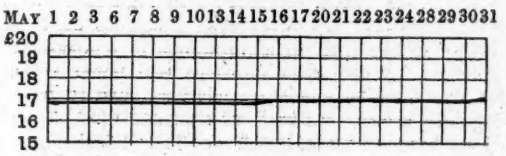
METAL MARKET.

Fluctuations in May.

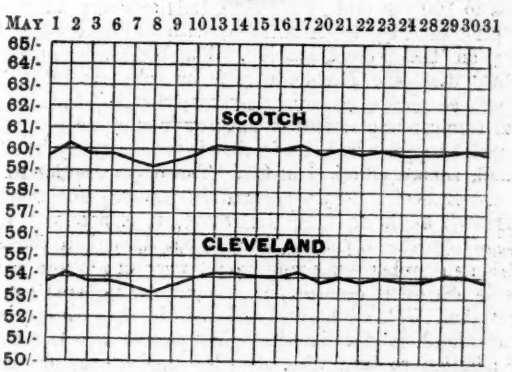
SPELTER (G.O.B's.).



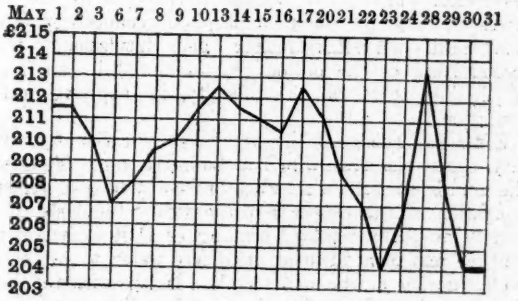
LEAD (ENGLISH).



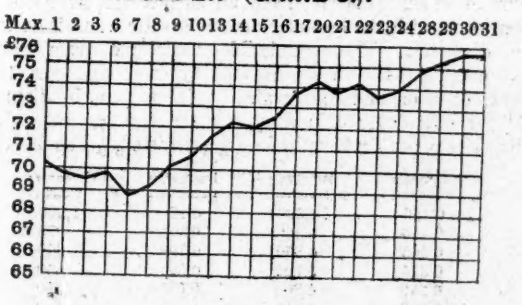
IRON.



TIN.



COPPER (G.M.B's.).



Stow-on-the-Wold Lighting.—The Rural Electric Supply Co. has applied to the R.D.C. for permission to use overhead lines for the supply of current to Bourton-on-the-Water, where promises to take current equivalent to between 500 and 600 lights have been given. Over 500 persons signed in favour of the request being granted, but the Council has referred the matter to a parish meeting for approval

THE AUSTRALASIAN TRAMWAY OFFICERS' ASSOCIATION.

WE have had sent to us a copy of the proceedings at the third annual conference of the above Association, which was held at Adelaide on October 31st, November 1st, 2nd and 3rd, last year.

Mr. O. W. Brain, M.I.E.E., electrical engineer to the New South Wales Government Railways and Tramways, Sydney, presided, and 23 members of the Association, representative of the various tramway undertakings in the Commonwealth, were present.

The president, in his opening address, stated the Association represented 17 undertakings, having £11,387,513 invested in them, with an annual revenue of £3,182,065, a staff totalling 12,469 employés and carrying over 471,000,000 passengers per year.

He then went on to consider the methods in use on the Continent of Europe and the United States to extend the area of service by the employment of high voltages, and expressed the view that the 1,000 or 1,200-volt direct-current method was the one best fitted to meet Australian needs.

The papers read at the conference included a description of the Adelaide tramways system, by Mr. W. G. T. Goodman, M.I.C.E., M.I.E.E., the engineer and manager, a paper on "Steel Tyred Wheels and Axles," by Mr. F. B. Shenstone, works manager, New South Wales Government tramways, and another on the "Use of Meters on Cars," by Mr. C. H. Wickham, A.M.I.E.E., the rolling stock superintendent of the Adelaide tramways system. Two papers were then presented dealing with sinking funds, namely, one by Mr. C. A. Smith, accountant to the Municipal Tramways Trust, Adelaide, on "Depreciation and Sinking Funds," and one by Mr. W. A. Strangward, secretary to the Prahran and Malvern Tramways Trust, Victoria, on "Depreciation Reserves and Sinking Funds." This latter was largely a reply to certain points advocated by Mr. Smith, who had rather minimised the necessity of provision for obsolescence, considering that, like earthquakes, the need for definite provision was unnecessary. Mr. Strangward took exception to this, maintaining that it was a real and important risk which needed special provision. He instanced his own company, the Melbourne Tramways Trust, which had at the moment a cable system costing nearly two millions, which it was proposed soon to supersede with an overhead electric system. Here very little of the cable cost could be utilised, and had not a sinking fund for this purpose been established and maintained, which would go far towards wiping out the cost of the conversion, the financial burden to be borne by the electrified system would be very onerous. Mr. Strangward's contention was that while it was unnecessary to hand down a tramway system to the next generation free of debt, we should certainly endeavour to bequeath to our successors assets to the full value of the debt thereon.

The last two papers were by Mr. James Coghlan, A.M.I.E.E., station superintendent at the Adelaide Station, on "The Operation of Steam Turbines and Turbo-Alternators;" and by the secretary of the Association, Mr. S. Russell Booth, secretary of the Adelaide Tramways Trust, upon "Discipline." In view of events following after this conference, the strike at Brisbane and the claim brought by the men's Union for higher wages and improved conditions of service, it is interesting to note the spirit animating the responsible officials of the undertakings. Mr. Booth pointed out the necessity for proper training, so that doing the correct thing became almost a habit, thus leaving the mind freer to deal with emergencies. The importance of loyalty and obedience were insisted on, and the effect of the observance of these not only on the undertaking but on the individual was insisted upon.

The writer was complimented upon the tone and spirit of the paper, various speakers emphasising special points of the subject. One mentioned how personal and general tidiness had much to do with efficiency, and another recommended as much sympathy as possible between all grades of the service. In his reply, Mr. Booth spoke of the importance of cultivating the sympathetic feeling of mutual loyalty and help. He referred to the club they had established at Adelaide, with its special rooms, committees on which officials and workers equally served, and the way in which the interchange of opinions on matters of mutual interest was carried on. It is to be hoped that after the present fights are over the various parties, in the spirit manifested in this discussion, will bury the hatchet, and endeavour to maintain the Australian tramway systems in the position they have already reached in the tramway world.

Various votes of thanks concluded the proceedings, Mr. P. J. Pringle remarking that he considered the discussion on the papers compared very favourably with those at similar gatherings at home.

Mr. Goodman, the chief engineer and general manager of the Adelaide Tramways Trust, was elected President of the Association for the present year, and Mr. Badger, of the Brisbane Tramways Co., first vice-President. It was arranged that if possible the next conference should be held at Brisbane.

Acton Electricity Supply.—Councillor G. W. Page has again been elected chairman of the Electricity Committee, and negotiations are being continued with the Metropolitan Electric Supply Co. in respect to questions of finance in dispute, respecting the terms of the transfer to the company of the Council's undertaking

THE USES OF COPPER-CLAD IRON WIRE.

In view of the high cost of copper on the one hand, and the liability to corrode of iron or steel on the other, it is not surprising that numerous attempts have been made to protect steel wire from the effects of atmosphere by giving it a copper coating and to use this for many purposes where copper wire has been considered essential, more especially in connection with electric transmission work. Some of these attempts have not proved successful, but the duplex wires manufactured on the Monnot patent have demonstrated their value to such an extent, that it is worth while referring briefly to some of the experiments and tests which have been made on such wires by the Duplex Metal Co., of Chester, Pennsylvania, and the experts who have been interested in the subject.

Before doing this it may be interesting to mention one or two of the earlier attempts. The first was probably made by Farmer and Milliken, who wrapped a copper strip round a steel wire and then tinned the complete wire. This was not much used commercially. In 1880 Martin in France made bi-metallic wire by the method, it is believed, of casting a sleeve of copper round the middle of a steel ingot, heating the combination and passing it through rolls, so that the copper spread in both directions of the steel, producing a rod which was afterwards drawn into wire. The cost of production was probably fairly high. In 1883 bi-metallic compound wire was formed by electro-depositing copper on steel wire. This, however, was not equal to a weld, and electrolytic effects were observed. Moreover, the cost of deposition is somewhat high. A practical improvement on Martin's work was, however, achieved by Monnot, who established the company mentioned above in 1905 to manufacture billets of compound metal under his patents, weighing 20 lb. each. At the present day these billets are made of 800 lb. weight. The process of manufacture is to take steel billets of any suitable composition, which are rolled to $5\frac{1}{16}$ in. round, and the bar is cut into 26-in. lengths. The ends of these billets are then drilled and tapped, and after being pickled and washed, the billets are given a preheating. The billet is then drawn inside a tube by means of a rod and a bushing screwed into the billet. This rod slides up and down in the centre hole of a three-jawed chuck which holds the tube and centres the billet in it. A steel flange is then screwed on to the bottom of the billet, forming with the tube a mould in which the billet is the core. The mould and billet are carried to a furnace of special design containing specially-prepared molten copper. The billet with its attached flange is then lowered out of the tube into this copper, being kept there for a sufficient time to wet the surface of the steel and form with it an alloy. When the reaction has reached a certain point the billet is drawn into the tube again and the whole is carried to a second furnace of the pit type, whose pots contain the purest commercial copper. The tube with its contained billet is lowered into the crucible; the molten copper rushes in through two openings in the top of the tube, unites with the alloyed areas and fills the mould. The tube is then withdrawn from the crucible, and when the copper is set, the chuck, rod and flange are unscrewed, the copper-clad billet is pushed out of the mould, and after the necessary preliminary heating, it is rolled to any required size and shape in a manner generally similar to the way in which steel is handled. In connection with this process, for the particulars of which we are indebted to an article by Mr. W. Tassin, in the *Chemical Engineer* of July, 1910, it may be said that although there is a difference between the physical properties of copper and steel, the two metals when welded by this process flow practically as one, and the proportional areas of copper and steel remain practically constant from the larger to the smaller passes in the rolls. There is a considerable amount of expense in crucibles, fuel, copper refining, copper lost as oxide, steel lost in oxide and scrap, and in addition the metal has to be rolled very carefully, and the drawing costs more than twice as much as that of the copper wire, if not for any other reason than that of speed. In spite of this, however, it appears quite evident that the duplex wire thus formed is well worth the attention of electrical engineers.

As regards the physical constants of the material, some tests made by the Ordnance Department of the United States Army at the Watertown Arsenal, Massachusetts, give the following figures :—

True elastic limit	50,825 lb. per sq. in.	
Johnson elastic limit	66,675	" "
Modulus of elasticity before stressing ...	21,400,000 lb.	
Modulus of elasticity after stressing ...	22,637,500	"
Tensile strength per square inch after repeated stresses	90,275	"

Some similar samples were also sent to the National Physical Laboratory, Teddington, where the modulus of elasticity was determined to be 23,100,000 lb. per square inch, while the linear coefficient of expansion for 1° C. was found to be 0·000012. This is only two-thirds that of copper and half that of aluminium, and owing to this small coefficient of expansion, combined with high elastic limit, it will be seen that very favourable conditions as to small variations in sag with great variations in temperature can be obtained. Where river crossings and power spans are under consideration special calculations have to be made, taking into account the loads of sleet and wind, for which provision has to be made, but for ordinary telephone service, for example, where pole spacing usually is 40 to the mile, it appears to be quite safe to use an increased span of 50 per cent. to 100 per cent., this giving fully as strong a line with copper-clad wire as is obtained with ordinary galvanised wire on the present spacing. For bond wire and other special uses, the Monnot wire is annealed, and it is then almost as pliable as soft-drawn copper wire. Bare copper-clad wire can be produced in this way in practically any form in which copper wire is made, that is to say, it may be either round, square, elliptical or flat. The only exception to this is the grooved trolley wire used in tramway undertakings, inasmuch as, in forming the groove, it is necessary so to gouge out the copper that it is cut through to the steel. Although probably the wire would wear out before appreciable corrosion occurred, it is necessary to point out this exception. Unless otherwise specified, the bare wire is always drawn hard, so as to give the highest possible tensile strength. In addition to bare wire, stranded products are also made. These are of two grades, electrical and mechanical. For the latter the same guarantee is given as for copper wire for mechanical purposes as regards strength, weld and non-corrosion, while for electrical purposes conductivity is also guaranteed. Weather-proofing and insulation can be accomplished by the ordinary methods, and if care is used in tinning there is no difficulty in applying rubber insulation.

Some particulars of the regular specification for 40 per cent. copper-clad steel wire may be interesting. The test of the weld is that the wire, when broken by torsion, shows no separation of the copper from the steel. Similarly, if the wire is broken by repeated bending, or if it is heated to a dull red and then quenched with iced water, there shall be no separation of the two metals. In the wire rod before drawing, when the surface is properly polished and etched, the alloy film is distinctly visible under a microscope. The wire in all shapes is free from all surface imperfections not consistent with the best commercial practice, and is accurate in diameter. The permissible variations from normal diameters are for wires $\frac{1}{8}$-in. and larger in diameter, 1 per cent. over or under; for wire $\frac{1}{10}$-in. to $\frac{1}{8}$-in. in diameter, $1\frac{1}{2}$ per cent. over or under, and for wire less than $\frac{1}{10}$-in. diameter 2 per cent. variation is permitted. The breaking

Diameter in inches.	Breaking weight.	Diameter in inches.	Breaking weight.
0·460	10,000	0·128	1,200
0·410	8,300	0·114	975
0·365	6,850	0·102	800
0·325	5,700	0·091	650
0·289	4,800	0·081	510
0·258	4,000	0·072	410
0·229	3,200	0·064	330
0·204	2,600	0·057	250
0·182	2,200	0·051	200
0·162	1,800	0·045	165
0·144	1,450	0·040	130

weight of 90 per cent. of the coils tested must be at least equal to the value stated in the table above, while the remaining 10 per cent. of the coils are not allowed to be more than 5 per cent. below these values; the breaking

weight of tinned wire is taken at 90 per cent. of the values given in the table on the previous page.

For electrical purposes the conductivity is determined by resistance measurements at a temperature of 75° F. The conductivity of 40 per cent. copper-clad steel wire is to be 35 per cent. of that of the same size and length of copper wire. For 30 per cent. material the conductivity may be as low as 25 per cent., while for 47 per cent. material the minimum conductivity is 45 per cent. of the same size and length of copper wire.

It will be interesting to make a *résumé* of the practical uses of this wire. For telephone work copper wire will not be absolutely displaced by it. For very long toll lines and for small wiring cable copper is still the best material; but in open-line distribution money can be saved by using a smaller copper-clad wire instead of standard copper, so making a saving of, perhaps, 40 or 50 per cent. in first cost, while obtaining greater strength than is furnished by copper; or an equal size of copper-clad wire can be used with a first-cost saving of 10 or 15 per cent., with a reduction of maintenance cost of, at least, 75 per cent.

For subscribers' connections the copper-clad twisted pair is claimed to show a saving in first cost over standard copper, the copper-clad having the same strength as copper, while weighing less than half as much, and, owing to its smaller size, supporting easily a greater weight of sleet than copper will. The difference of weight means a large saving in the cost of handling the wire. As compared with galvanised iron wire, it will be seen that no allowance need be made on the duplex metal for loss of strength due to rust.

For telephone lines up to at least 200 miles No. 9 Brown and Sharpe gauge copper-clad wire gives practically perfect results, costs less than copper, and is stronger, and the Great Northern Railway system of America has installed this size of duplex wiring for telephone train dispatching. This means nearly 9,000 miles, or 1,800,000 lb. of duplex metal.

In addition to this, duplex wire is rapidly becoming standard material for municipal, fire, and police telegraphs. The City of New York has several hundred miles in use, some of which have been at work for over three years, the importance of a strong wire for this purpose being recognised. Other cities are following this example, the decision not being reached on a cost basis, but on account of strength. Over 60 railways in the United States are using copper-clad duplex metal wires in their signal systems, where the mechanical strength of the duplex metal wire has shown itself superior both to copper and to galvanised wire. For bond or tie-wires it is being largely adopted, as the difference of conductivity between these bonds and those of galvanised iron is most apparent. While the first cost of the copper-clad bond is much above that of the galvanised type, the difference is made up in a short time by the saving in cost of current. The bonds can be made theft-proof by sherardising them in order to produce a surface exactly like galvanised iron bond-wire.

The principal uses for the wire which will interest electrical engineers, however, are in connection with electric power transmission and electric railways. As regards the former purpose, copper-clad wire was first used as a guard-wire for lightning protection, inasmuch as galvanised wire, when used for this purpose, rusted. When copper was tried, it was found that the usual span in power transmission required an excessively large size of copper in order to sustain its own weight. Copper-clad wire then came into use over river crossings. The Great Western Power Co., in California, has had in service for over two years seven 3,100-ft. spans and seven 2,600-ft. spans of this wire. Later, in 1909, the Canadian Niagara Power Co. utilised the metal in four 4,000-ft. spans to cross the Niagara River, while a year later 16 more spans were used, owing to the fact that no other material ever stood up so well under the conditions of service in this locality. For telephone line service, for generating stations and distributing stations, a great deal of duplex wire has been used, because it can be strung on to the poles carrying the transmission line, whereas if bare copper were used it would be necessary to run a separate line to carry it. Many secondary circuits running from transformers to consumers carry so little current that the copper wire used is based on strength, and not on resistance. In such places copper-clad wire can be used to great advantage, and, in addition to this, a great many series arc and series incandescent circuits are now operated with duplex wire, the requisite here also being strength, and not conductance. In electric railways, besides telephone and signal lines, it is found that copper-clad wire is especially useful for curves, as its high strength permits the curve to be kept up tight, while it wears about half as fast as copper. It has been used on the Williamsburg Bridge, connecting New York with Brooklyn, and before the company mentioned sold a foot of trolley wire, 3,000 ft. of No. 4 B and S gauge duplex wire had been used by 800,000 cars on this route. In places of dense traffic the slow wearing property of the duplex metal wire becomes very valuable, because in such cases a break in the wire means stoppage of the cars or trains, which again means a heavy loss of money. For high-speed transit, although copper-clad wire has increased resistance, its good wearing properties are most valuable, and it has, therefore, in many cases been found advisable to increase the section of the feeders, in order to compensate for the increased resistance of the duplex metal, and at the present time copper-clad trolley wire is in use, or under test, by over 200 electric traction systems in the United States.

From the above notes, therefore, it is evident that a distinct development in the materials for electric power transmission has been obtained by Mr. Monnot's invention, and in view of the increasing use of overhead transmissions for heavy power purposes, it is highly advisable that British engineers should take into consideration the possibilities of this material.

REVIEWS.

The Induction Motor. By B. F. Bailey. London: Hill Publishing Co., Ltd. Price 10s. 6d. net.

The author in his preface admits the existence of many excellent works dealing with the induction motor, and proceeds to justify the issue of his own book on the subject by the following rather vague and involved sentence: "The endeavour has been to produce a work that will have the greatest possible value for those who wish to inform themselves more fully regarding the theory of the induction motor than they can by studying the elementary text-books, but who, at the same time, do not care to go too deeply into the theoretical aspects of the question."

The reviewer is inclined to take this sentence, in which the author summarises his purpose, as being typical of his execution also. The chief defects of the book (and such defects cannot be unimportant when they are found in a text-book intended for the use of students) are a general looseness in style and in reasoning and a tendency to deal in generalities in a way which makes it difficult for the reader to gather either clear ideas or exact knowledge. In this connection, one more passage may be quoted from the preface. "It is the writer's belief that nine-tenths of the trouble experienced by many people in studying the action of electrical machinery comes from the lack of a clear idea of the elementary physical actions. An attempt is made to apply mathematical reasoning to the problem before this understanding is obtained, and the result is a mental haze, which is, perhaps, never dissipated." It has seemed to the reviewer that it is just in the explanation of the physical actions that the author is least successful, and that the last sentence which has been quoted might be applied not unfairly to the more theoretical parts of the author's own book.

The first chapter deals with the elementary theory of the induction motor and leads up to a simple vector diagram of the currents, voltages and fluxes of the motor. The theory is presented in a rather general form of discussion, which would be much helped by a better selection of diagrams and more exact reasoning. A good diagram and more concrete presentation of the matter would have made impossible such statements as the following (p. 13): "As soon as we put load on a motor, current is produced in the rotor, and this current tends to produce a flux through the air-gap. This

flux would be *in the same direction as the rotor current*, and consequently nearly at right angles to the main flux." Is such a statement as this calculated to promote "a clear idea of the elementary physical actions?"

The second chapter carries the theory further, and in it is developed a more complete form of diagram for the motor, in which the losses are taken into account. The diagram is practically equivalent to the Heyland form, but with the modifications which are usually found in American text-books. Whatever may be said in favour of the Heyland diagram from the point of view of its utility in practice, it can hardly be described as likely to give "a clear idea of the elementary physical actions" of an induction motor to a student, without a much more careful introduction than we find in this book.

In this chapter, again, we find statements which are calculated to produce entirely wrong impressions on the student's mind. Thus, on page 17, we read "For example, it will be evident at once (it was *not* evident at all to the reviewer) that doubling the number of turns on the rotor and at the same time making the cross-section of the conductors half as great, would in no way change the characteristics of the machine. Hence, in general we are at liberty, in developing the theory, to choose the ratio of the rotor to stator winding, which gives the simplest ratio. For this reason we choose the ratio of one to one." Accordingly, the diagram which is to show the behaviour of the induction motor is constructed for a motor having equal turns in the stator and rotor windings. This would be quite legitimate, if its application to a real motor having a different ratio of windings were subsequently explained. How completely the author has forgotten the real motor, and how far he has confused actual conditions with hypothetical ones, is shown in the definition which he gives for the leakage coefficient of an induction motor on page 26. He defines this coefficient as "the ratio of the magnetising current to the *rotor* current of the motor with the rotor locked, and assuming that the rotor has only reactance and no resistance." This definition could only be correct for his ideal motor, and is absolutely untrue and misleading when offered as a general statement.

The measurement of torque in terms of units called "synchronous watts" has often been criticised as tending to produce confusion between units of power and units of torque, which are of different dimensions. What would the critics have to say of the following sentence (page 24)? "The *mechanical output* of the motor is evidently $D(1-s)$, where D is the *synchronous torque*." It is to be remembered that the factor $(1-s)$ is here a pure numeric, s being the slip expressed as a fraction. No hint is anywhere given that power and torque cannot be measured in the same units, and that they can only have a *numerical* equality.

Chapter IV deals with starting devices, and in it are described and illustrated a number of forms of starters, auto-transformers and protective devices. There follow chapters on variable-speed motors, general considerations relating to design, an example of a design, special types of motors, single-phase motors and single-phase commutator-type motors. These chapters contain a good deal of interesting information, most of which is, however, easily available from other sources, while its presentation has hardly sufficient merit to form a strong recommendation for the author's work.

The book will, perhaps, prove more useful to American readers than to readers here, on account of the illustrations of American apparatus which it contains. In this country, the reviewer does not anticipate that it will meet with a wide circulation, or that it will fill any general want.

Radio-Telegraphists' Guide and Log-Book. By W. H. Marchant. London: Whittaker & Co. Price 4s. 6d. net.

The author's object has been to provide a book useful to those engaged in the practical operation of wireless stations, and in this he has succeeded. The introductory chapter surveys the principles and developments of wireless telegraphy. Possibly the author assumes too great familiarity with the subject in parts, at least as judged by the elementary matter occasionally interspersed. In later sections of the volume greater practical knowledge might safely have been assumed in a number of places. The expert operator would probably appreciate a wider and more critical treatment of the arrangement of transmission circuits than is actually given in Chapter II. The descriptions of individual systems of working are well arranged and most instructive. There seems no reason why the variometer notes (pp. 91-2), should not be included in Chapter IV. Improved forms of condensers and other accessory apparatus might have been discussed at greater length, and there are quite a number of new detectors which should have received some mention. More attention should have been paid to the selection of telephone receivers and the conditions for maximum sensitivity, and examples might well have been given to enable operators to design inductances, &c., for temporary or permanent use.

Military wireless sets are well treated, but no information is given concerning the numerous special equipments recently designed for, and adopted by, fishing vessels, &c. In a later edition the author will probably deal with wireless telephony; this subject is already of great interest to every wireless operator, and there can never be any such distinction between wireless telegraphy and telephony as exists between the two means of communication over wires.

We should have liked more information concerning directive wireless telegraphy and more definite particulars regarding the relative merits of various detectors and the relationship between transmitting power, aerial dimensions and distance of effective transmission.

The book is admirably illustrated, and has a serviceable index. The tables and curves, &c., in the appendices are most useful, and the list of stations (transmitting commercial messages), with their code calls, ranges, wave lengths and hours of attendance will be much appreciated by users. A complete list of all wireless stations of any importance, preferably illustrated by a map, would be very valuable.

We are inclined to think that some of the matter included in the text will be redundant so far as operators are concerned, though it will be quite necessary and interesting to the general reader. With regard to the log-book which forms such a feature of the volume, this is quite useful, but many operators will prefer an independent log volume, and we question whether the cost of inclusion of the log sheets might not better have been devoted to expanding the information given in the book itself (for example, in quoting quantitative data drawn from the author's experience, standard results to be expected in working, and so on). If the log-sheets are retained in later editions, the width of the columns might well be increased by sacrificing some of the present marginal allowance.

Manual of Wireless Telegraphy for the use of Naval Electricians. By Commander S. S. Robison. London: S. Rentell & Co., Ltd. Price 7s. 6. net. Second Edition.

The information given in this work of 212 pages has a distinct leaning towards the practical working side of the subject, and should, therefore, fill a requirement much felt in the literature of wireless telegraphy. It is primarily intended for use in the U.S. Naval Institute, and it is this particular field of usefulness that the author has had mainly in mind in framing the work. It is, therefore, to a large extent a set of instructions as to the manner of construction and use of wireless installations, together with a sufficient amount of technical information and theoretical matter to render the whole an intelligent and concise explanation of the subject. Details of working adjustments and tests are fully treated. The work has been considerably revised and added to by Dr. Austin, and, as a result, its value has been much enhanced since its first publication.

Some of the diagrams, especially those relating to the disposition of lines of electric and magnetic flux, are crude and wanting in accuracy, but on the whole the illustrations, of which there are some 115, are good and clear.

A chapter on wireless telephony, and appendices of useful electrical tables and data, form features of the work. The latter are much fuller than usual in works on wireless telegraphy, and are of a very useful character.

The work has much to commend it, and should be specially useful to those concerned in the practical operation of wireless telegraph stations.

Chapter V on transmitters is especially good, and describes various methods involving the use of modern rotating spark gaps giving musical transmission. Chapter VII on installation and adjustments is also a commendable one.

Dynamo and Motor Attendants and their Machines. By F. Broadbent. Sixth Edition. London : S. Rentell & Co. Price 1s. 6d. net.

In revising this book the author has rewritten the introductory chapters, those on starting and controlling switches, on testing motors for horse-power and on A.C. motors. The addition of information on accumulator charging and the paralleling of alternators has increased the value of Chapter 8, but a short, independent chapter on accumulators and their charging would be preferable to the present arrangement. In the next edition it would be well to give attention to the arrangement and care of the special, more or less, "automatic" house lighting equipments which are gaining such popularity.

Chapter 5, on choosing a dynamo or motor, might with advantage include notes on the considerations governing the choice of type of winding. The information in Chapter 1 might well be distributed between Chapters 6 and 8, and, by collecting all the notes on faults and breakdowns in one place, considerable space might be saved without detracting from the importance which is rightly attached to this subject, and without sacrificing the clearness and accessibility of the information presented.

The new chapter on the brake horse-power of motors deals with the subject in a manner admirably suited to the class of readers concerned. A few simple diagrams would undoubtedly facilitate the comprehension of the otherwise excellent notes on the principles of alternating-current motors ; repulsion and single-phase commutator motors deserve rather longer treatment than is actually given, space for such additional matter being found by reducing the size of a number of the present line blocks. The illustrations in the new edition are exceptionally clear and useful ; most of the half-tone blocks have been omitted, but of the remainder there are still a few which might well yield place to more instructive material. Throughout the book, the matter on theory and general principles is clear and sufficient for the end in view. The information presented is thoroughly practical, and the volume can be cordially recommended to all dynamo and motor attendants. The author and publishers are to be congratulated on producing so valuable a treatise at so low a price.—R. E. N.

BIRDS AND HIGH-TENSION LINES.

By Wm. Manktelow

There are still large numbers of birds killed outright, or so far incapacitated that they die of starvation, by injuries received in collision with telegraph wires. Undoubtedly there are relatively fewer fatalities now than in the early days of the telegraph (demonstrating a gradual instinctive avoidance of the danger by birds), but heavy toll is still demanded among partridges, pheasants, snipe and such species, despite the practice of hanging small metal plates on the wires to make them more visible in game districts.

A more insidious danger to bird life is now to be found in the high-tension electric transmission wires, which are rapidly enmeshing every civilised country. The old collision risk still exists, though, if anything, in a less degree, for the larger wires are more readily discerned than telegraph conductors ; but the special danger occurs when the bird alights on or rises from the wires. How popular telegraph wires are as resting-places for all birds and as assembly centres for migratory species need hardly be mentioned. On these wires the birds incur no special risk, but if, when settling on or rising from high-tension lines they happen to touch two wires simultaneously, instant death is their reward. In the case of extra-high-tension lines, the distance between conductors is usually too great for such simultaneous connection to be effected, but the overall span of even comparatively small birds is surprisingly large, and is quite sufficient to bridge the distance between lines at a sufficient difference of potential to inflict a fatal shock. Ironically enough, birds probably regard these lines as specially safe, owing to their exceptional height from the earth and their human enemies.

On a typical German overland transmission route, dead birds, varying in number from two or three up to 20 or more, were found in groups at the feet of the various supporting poles and towers (which offer a specially tempting perch). The larger birds are, of course, specially liable to destruction ; starlings, crows, jackdaws, yellow-hammers and buzzards, besides an extraordinary number of hawks, have been found dead along German transmission lines, and it has been suggested that there is grave danger of the latter birds being practically exterminated in districts traversed by high-tension transmissions. Hawks are particularly fond of perching on high spots, and as many as five have been found dead beneath three masts ; in view of the comparative rarity of the species, such wholesale slaughter must soon lead to its extirpation in districts where high-tension lines are common.

We have no reason to suppose that birds have either intelligence or instinct which will enable them to discriminate between high and low-tension wires ; they may ultimately come to regard *all* overhead wires as unsafe perches, but the development of such instinct must take many years, and, meanwhile, high-tension lines are steadily increasing in number. Apparently our feathered friends and enemies alike must be subject to a decimation, which neither Bird Laws nor other protective measures can avert.

There is, however, another side to the question. The killing of a bird places the transmission line practically under short-circuit for a greater or less period, according to the time the body remains suspended between the lines. So far it has happened that extra-high-tension lines have chiefly traversed countries where large birds, such as eagles, are common. These creatures can easily span the distance between the transmission lines, and their great size makes it a difficult matter to "burn-out" the heavy short-circuit placed on the line, should the carcass remain in position after the bird is dead. At the best, the mishap will probably strike an arc, which is blown along the line—often for great distances—and it is not uncommon to experience a more or less serious cessation of supply from this cause.

One of the most extraordinary mishaps in high-tension distribution due to birds occurred last summer in a certain Wurtemberg community (a full account may be found in the *Elek. Anzeiger*, No. 92, 1911). The township is supplied by a large "over-land" distribution scheme, and the transformer house serving the locality is built on top of a lattice-work tower, which is connected to an earth-plate and on which are mounted the stems of the insulators carrying the incoming and outgoing lines.

The incoming 10,000-volt lines are attached to strain insulators, and from each line current is led, through inductance coils, to the apparatus within the transformer house. The original inductances were in the form of spirals held vertically between the strain insulators and a second higher set of insulators.

On the day of the disaster, a sparrow hawk threw a flock of starlings into a panic, and the birds flying blindly towards the transformer house, some of them became entangled between the inductance spirals and the insulator pins. As a result, the transformer house tower was connected to the 10,000-volt line, and had its earth plate been effective, the resulting rush of current would have opened the main station breakers. Unfortunately, only one earth plate had been provided, and after an exceptionally dry summer this was found to be in quite dry soil, hence the high-tension charge took the easiest remaining path to earth, which proved to be *via* the various house installations (designed to operate at 3 × 220 or 3 × 130 volts). Quite a number of fires naturally resulted, in endeavouring to extinguish which (of course with *water!*) several persons received violent shocks. Fortunately, no one was seriously injured, and only one house, which was unoccupied at the time, was seriously

damaged by fire. A number of birds—among them the chief culprit, the hawk—were found in a more or less fragmentary condition near the transformer house, and to avoid a repetition of this episode, several earth plates have been installed in parallel and straight leads have been substituted for the spiral inductances.

COMPLETION OF WORKS IN TIME.

[FROM A LEGAL CONTRIBUTOR.]

Among the clauses which give rise to disputes between employer and contractor there is none more difficult than that which specifies the time within which the works are to be completed. A number of causes may operate to bring about delay. The ever-increasing complexity of commercial relations; labour disputes; carriage by land and sea—all these are factors in the matter. Finally, it is often necessary to sub-contract for portions of the work, and the pace is then the pace of the slowest. For these reasons it is important for the contractor to see that he gets as much rope as possible in the first instance, or to make sure that the employer's engineer has full power to extend the time.

Failure to erect works within the specified time, where time is of the essence of the contract, may lead to grave consequences for a contractor. In one case the defendant contracted to fit up and complete machinery for the plaintiff within a reasonable time, but failed to do so. It was held that the jury, though not bound to assess the damages at the amount of the profits under a contract with a third party which the plaintiff was prevented from earning, might do so if they were satisfied by reasonable evidence that the plaintiff would have earned these profits if not prevented by the breach of contract.

Delay on the part of the contractor may be excused if it can be shown to have been caused by failure on the part of the employer to give access to the site or to deliver plans.

It is hardly necessary to consider the case of a contract, the performance of which has not to be carried out within a specified time, in view of the fact that every well-known form of contract provides for work being completed by a particular day. It may be useful, however, to consider the meaning of some of the terms used in relation to time. Thus a contract may have to be performed "directly," or as soon as practicable. In one case the plaintiffs employed the defendants to make a gunpowder pile-driver, which they agreed to provide "as soon as possible." It was held that by the words the defendants must be taken to have meant that they would make the gun as soon as it could be made in the largest establishment with the best appliances. "I do not think," said Cotton, L. J., "that these words can be taken to mean that the defendants merely promised to make the machine as quickly as the means at their disposal might allow, however rashly they might have entered into the contract, as such a stipulation would be unusual."

The following is a simple form of time clause:—"The contractor shall commence the works immediately, and shall proceed with the works to the satisfaction of the engineer, and shall complete and deliver over to the employer the entire works by or before the (naming a day), unless the engineer shall fix or substitute in writing another date for the completion of the contract, in which case the substituted date shall be the date for completion, as though the same had originally been inserted in the contract." This form makes no provision for delay caused by the ordering of extras, strikes, inevitable accident, "the act of God," &c. Many contractors will insist upon the insertion of clauses relieving them from responsibility in such cases; but sometimes it is given to the engineer by notice in writing "to delay or suspend the whole or any part of the work during unsuitable weather, or for any other sufficient reason." It is obvious that a comparatively short delay by stress of weather might involve very great delay in the completion of the whole work, as where, for instance, it became impossible to complete work in the summer time which could not be efficiently done in the winter season.

The ordering of extras may render completion within the time limit wholly impossible; but if the contract provides that the work shall be completed by a certain time, whether extras are ordered or not, the contractor will be bound by his rash undertaking. This was laid down in the well-known case of Jones *v.* St. John's College, 1871, L.R. 6, Q.B. 115. There the plaintiff contractor agreed to do the work by a certain day. The contract provided that extra works should be ordered in a particular manner, and that, notwithstanding such extra work, the time limit was not to be extended, unless by an order signed by the clerk of the works, and countersigned by the college bursar. Extra work was done, but there was no express extension of the time limit. It was held that as the contractor had agreed expressly to do all the work, and extra work if ordered, within the original time limit, the contractors were bound to complete within the specified time limit, although it might involve an impossibility. It may be assumed, however, that the Courts will not be very willing to bind a contractor down to the completion of all the work, including extras, within the specified time; and it is settled law that if the employer orders extras and there is no clause similar to that considered in the case of Jones *v.* St. John's College, an extension of time will be allowed to the contractor. This is well illustrated by the case of Dodd *v.* Churton, 1897, I.Q.B. 562. There the contract provided that the work was to be done within a specified time, but it also contained a clause to the effect that other work might be ordered by way of addition to that specified in the contract. It was also provided that any authority given by the architect for alterations or additions was not to vitiate the contract. Extra work having been ordered, the builder was unable to complete the contract in the specified time. It was held that he was excused. The provision that the contract was not to be vitiated was held not to exclude the commonsense principle that where performance of a condition is rendered impossible by one party to a contract, the other party is exonerated from the performance of it. If the engineer has power to extend the time, and the contractor applies for a decision as to an extension of time, he is bound by that decision. In Sattin *v.* Poole, 1901, 2 H.B.C. 337, the plaintiff agreed to build a house for the defendant. The work was to be completed by a certain day, but the contract provided that if, in the opinion of the architect, the works were delayed by reason of authorised extras or additions, or, in consequence of the contractor not having received in due time necessary instructions from the architect, for which he should have applied in writing, the architect should make fair and reasonable extension of time. The work having been delayed, the builder applied for an extension, but the architect did not reply at once. The builder then sued for £681, which had been allowed on a certificate, subject to the question of penalties for delay. After this the architect wrote granting an extension, but not to the actual date of completion. The builder then sought to call evidence to show that the delay was caused by the architect in ordering extras. In effect, he wished the Court to go behind the decision of the architect. This the Court declined to do, holding that the architect's ruling was final. The Judge said: "The construction of the clause is that the parties did not intend to let it be held that there was any delay, unless the builder applied to the architect."

TRADE WITH MEXICO.

The British Consul at Vera Cruz in referring to the Vera Cruz Electric Light, Power and Traction Co., a British company which supplies the town with electric light and power, and also operates the electric tramway system, states that this company is projecting the extension of its system during the coming year to reach certain neighbouring villages, where it is estimated that the return on the outlay would prove profitable owing to the large Sunday and holiday traffic which it is presumed would be created by excursionists and others who would be attracted to these neighbouring resorts. The materials for the permanent way and a greater part of the machinery purchased by the company were of British manufacture, but the cars are all of American build, being of light structure, single-deckers, completely open in order to meet the conditions of the climate.

Later in his report the Consul states that the trade of Vera Cruz, as far as foreigners are concerned, is principally in the hands of Spaniards, Germans, and French, in the order named, there being only one British house. All the wholesale houses without exception maintain a retail department. A large part of the commerce of Vera Cruz is in the hands of commission agents, these concerns generally acting as Custom-house brokers, forwarding agents, steamship agents, &c. All are ready to undertake commissions, either buying or selling, but none of them will make purchases direct from abroad for their own account with a view of introducing new goods, if there is any personal risk in the undertaking. If a commission agent gets an inquiry for any particular speciality, he will endeavour to secure an order, but without an inquiry he will do nothing. The Consul points out that many of the inquiries for information sent to him by manufacturers at home, are of such a nature that it is very difficult to give a satisfactory reply, the conditions in Vera Cruz differing very greatly from those in the United Kingdom. Frequently information is asked respecting the addresses of wholesalers, brokers or retailers, distinctions which can hardly be said to exist in this country at large. For example, wholesale machinery and hardware importers will sell you anything from a needle to a complete sugar mill. There are wholesale haberdashers and linen drapers doing a very large business who will also sell you a cargo of cement and are likewise interested in the manufacture of cigarettes. A timber merchant is also the owner of a plant for rectifying spirits and distilling liquors. Goloshes and other waterproof articles are sold principally by the ironmonger. The wholesale chemist with the usual retail department attached will carry in the window of his shop at Christmas time probably the best selection of dolls to be found in the town, and so on throughout all branches of trade. It would be an advantage to representatives if in addition to being equipped with a full line of samples and prices, they would get a knowledge of the Mexican Customs tariff and post themselves on ocean freight rates. The "Mexican Year-Book" which is on sale by McCorquodale & Co., Ltd., 40, Coleman Street, London, gives valuable information on this and other points of interest to manufacturers and their agents. Catalogues and other trade literature should, if possible, be in Spanish. An American mercantile agency has a branch in this port, from whom can be derived any information as regards the financial responsibility of business houses in this district. All persons engaged in commerce in this port and many of those in the interior are members of the "Camara Nacional de Comercio de Vera Cruz" (National Chamber of Commerce of Vera Cruz), to whom catalogues and similar matter can be sent.

The use of petroleum as fuel is rapidly supplanting that of coal in all branches of commerce; all the railways having their termini in Vera Cruz have now had their engines converted in order to use liquid fuel, with the result that the coal trade, in connection with which the handling of cargoes gave employment to a large number of people, has practically ceased. Arrangements are now being made whereby in the near future it will be possible for oil-burning vessels to count on a constant supply of fuel which will be available apparently at an economical figure, judging by the prices ruling at present and the figures at which contracts have been made.

The British Vice-Consul at Jalapa reports that the Jalapa Railway and Power Co. owns and operates the railway connecting Jalapa with the small towns of Coatepec, Jico and Teocelo. The company also owns the power plant, which produces about 1,700 H.P. derived from a waterfall near Jico, some 14 miles from Jalapa. The power is used for lighting the towns above-named, and also supplies various small industries in these towns with power. It is an American-owned concern.

A DIRECT READING WAVE METER.

BY S. M. POWELL.

IN wave meters, hitherto in use, it has generally been necessary to adjust a variable capacity or inductance in a tuning circuit till maximum current flow is attained in the latter. The corresponding frequency and wave length for each setting of the variable capacity or inductance, being determined once for all, the frequency and wave length of the oscillation examined is at once known.

A new type of wave meter, by Erich Huth, depends also upon the principle of resonance, but it is no longer necessary to determine by trial the resonant setting of a variable tuning condenser or inductance. Resonant conditions are attained automatically, and the frequency and wave length of the oscillation examined are read directly on a permanent scale.

In figs. 1 and 2, representing the construction of the new instrument, C is a plate condenser, L an inductance coil, and A a neon or helium tube, connected so as to show, by its illumination, the occurrence of resonance in the tuning circuit. The movable plate of the condenser, carrying the neon tube on an extension arm, is rotated by clockwork or an electric motor, so that the capacity of C varies continuously and periodically over the whole range between its minimum and maximum values. During each rotation of C, the resonant relationship between C and L for the particular case examined, is swept through and, at the moment of its realisation, the neon tube is lighted. This occurs at the same point in each revolution and, at a speed of the driving motor of 300 R.P.M., the resonant setting is passed five times per second, so that by persistence of vision, the observer sees a steady band of light at the resonant position of C (and A). By placing a suitably calibrated scale B behind the path of motion of the tube A, the frequency and wave length of the oscillations exciting L can be at once read.

The observed position is the mean of a number of rapidly successive automatic settings, and the whole conditions of working result in the readings being much more accurate than individual hand settings, besides being more easily obtained. Variations in the excitation of the tuning circuit merely alter the brightness of the indicating tube; fluctuations in the wave length measured cause a broadening or waving of the luminous band according to their frequency of occurrence.

The energy consumption of the meter is lower than that of meter circuits using hot-wire instruments. The neon, or helium, tube only consumes energy during the fractions of a second in which the resonant setting is traversed, and it is possible to work

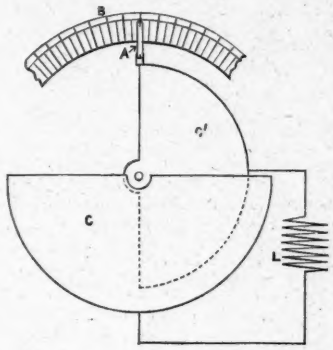


FIG. 1.

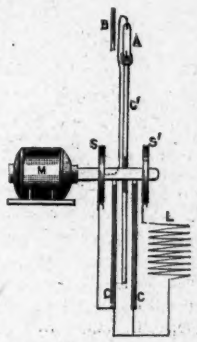


FIG. 2.

with much looser coupling than is required by indirectly reading wave meters. This further enhances the accuracy obtainable by avoiding appreciable reaction of the tuning circuit on the primary circuit. Owing to their limited burning period, the indicating tubes will last several months, in every day use. The outward appearance and component parts of the tube are as shown in fig. 3; the tube is held in a cartridge consisting of a central sleeve of insulating material, and two screwed metal end caps. The rotary disk carrying the tube is accessible through a door in the containing case of the meter, and thus tube replacement is effected with the minimum of trouble and delay.

The wave meter is built in two forms; one, a self-contained set, mounted between pivoted forks, capable of being used in any position, and very suitable for portable work and for laboratory and demonstration use; the other, a wall type for permanent erection on switchboards, &c. Both types have two ranges, covering wave lengths from 500 to 1,200 m. and from 1,200 to 3,000 m. respectively. Conversion from one range to the other is effected by turning through 180° a vulcanite switch knob at the centre of the dial. This switches in or out auxiliary condenser plates; only a single inductance coil is required, hence the length of a strange wave can be determined within a very few seconds.

In using the meter, the coupling coil is moved to and from the circuit under examination till the indicating band of light is from ½ to 1 mm. broad. If sufficiently loose coupling cannot be obtained to yield a narrow band, readings are taken at the brightest part of the narrowest band obtainable. Readings should be taken on the

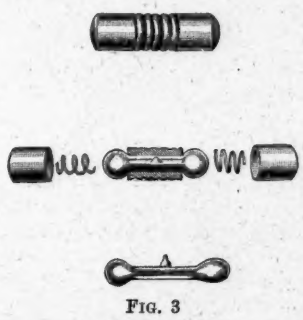


FIG. 3

lower range of the instrument wherever possible; on changing from the higher to the lower range, the indicating band widens considerably, and looser coupling should be secured. The accuracy of the instrument is such that wave lengths can be determined correct to the nearest metre.

By simply disconnecting the condenser C, by withdrawing a knob in the base-plate of the instrument, the latter indicates the amplitude and purity of the oscillations examined, and, thus used, the instrument is indispensable to wireless stations working with undamped oscillations. When used as an "amplitude controller" the energy consumption of the instrument is considerably increased, the neon tube being permanently excited; the coupling of the inductance coil must, therefore, be considerably tightened.

This instrument should be of great value as a permanent indicator of wave lengths in all wireless stations, particularly in those using an arc as the source of high-frequency oscillations. Variations in the arc length may easily cause 5 per cent. alteration in the wave length of the station. This not only increases the difficulty of tuning at the receiving station, but may even

materially reduce the effective transmitting radius of the sending station. The root of the trouble may be avoided by the use of the new wave meter, the indications of which, varying in instantaneous and exact sympathy with every alteration in the conditions of the primary oscillating circuit, make possible a permanent control of frequency such as could not be obtained by any of the older methods of measuring wave lengths.

The need for, and advantage of, the instrument is even greater in arc stations using more than one frequency, and in all stations engaged in wireless telephony, the success of which depends essentially on constancy of the transmitting wave lengths.

TRADE STATISTICS OF SOUTH AFRICA.

The following statement, showing the imports of electrical and similar goods into British South Africa during the year 1911, has been taken from the recently issued official trade statistics. The figures for 1910 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1910.	1911.	Increase or decrease.
Detonators.—	£	£	£
From Great Britain ...	27,000	25,000	— 2,000
„ Germany	8,000	8,000	—
Total ...	35,000	33,000	— 2,000
Fuses.—			
From Great Britain ...	81,000	83,000	+ 2,000
„ Germany	46,000	41,000	— 5,000
„ Other countries ...	—	1,000	+ 1,000
Total ...	127,000	125,000	— 2,000
Asbestos manufactures.—			
From Great Britain ...	700	700	—
„ Other countries ...	500	1,700	+ 1,200
Total ...	1,200	2,400	+ 1,200
Brass manufactures.—			
From Great Britain ...	21,000	27,000	+ 6,000
„ Germany	1,000	1,000	—
„ Other countries ...	2,000	3,000	+ 1,000
Total ...	24,000	31,000	+ 7,000
Copper, plate and sheet.—			
From Great Britain ...	5,000	4,000	— 1,000
„ Germany	1,000	1,000	—
Total ...	6,000	5,000	— 1,000
Copper manufactures.—			
From Great Britain ...	3,000	3,000	—
„ Other countries ...	—	1,000	+ 1,000
Total ...	3,000	4,000	+ 1,000
Electrical cable and wire.—			
From Great Britain ...	182,000	156,000	— 26,000
„ Germany	75,000	62,000	— 13,000
„ United States ...	4,000	12,000	+ 8,000
Total ...	261,000	230,000	— 31,000
Electrical fittings, including posts.—			
From Great Britain ...	118,000	144,000	+ 26,000
„ Germany	215,000	93,000	— 122,000
„ Holland	2,000	1,000	— 1,000
„ United States ...	21,000	19,000	— 2,000
„ Other countries ...	4,000	9,000	+ 5,000
Total ...	360,000	266,000	— 94,000
India-rubber of all kinds.—			
From Great Britain ...	30,000	32,000	+ 2,000
„ Germany	2,000	5,000	+ 3,000
„ United States ...	3,000	15,000	+ 12,000
Total ...	35,000	52,000	+ 17,000
Lamps and lampware.—			
From Great Britain ...	19,000	20,000	+ 1,000
„ Germany	14,000	18,000	+ 4,000
„ Sweden	1,000	—	— 1,000
„ United States ...	10,000	10,000	—
„ Other countries ...	2,000	3,000	+ 1,000
Total ...	46,000	51,000	+ 5,000
Machine bands and belting.—			
From Great Britain ...	131,000	123,000	— 8,000
„ United States ...	24,000	37,000	+ 13,000
„ Other countries ...	1,000	1,000	—
Total ...	156,000	161,000	+ 5,000
Electrical machinery.—			
From Great Britain ...	254,000	172,000	— 82,000
„ Germany	480,000	318,000	— 162,000
„ United States ...	71,000	40,000	— 31,000
„ Other countries ...	5,000	4,000	— 1,000
Total ...	810,000*	534,000	— 276,000

* Large figures, due to purchases for Victoria Falls Works.

Cranes, elevators and lifts.—			
From Great Britain ...	73,000	37,000	— 36,000
„ United States ...	2,000	2,000	—
„ Other countries ...	3,000	1,000	— 2,000
Total ...	78,000	40,000	— 38,000
Mining machinery.—			
From Great Britain ...	910,000	666,000	— 244,000
„ Germany	161,000	119,000	— 42,000
„ United States ...	164,000	159,000	— 5,000
„ Other countries ...	16,000	32,000	+ 16,000
Total ...	1,251,000	976,000	— 275,000
Machinery not specially mentioned (other than agricultural, manufacturing, &c.).—			
From Great Britain ...	466,000	429,000	— 37,000
„ Germany	32,000	22,000	— 10,000
„ United States ...	41,000	47,000	+ 6,000
„ Other countries ...	13,000	10,000	— 3,000
Total ...	552,000	508,000	— 44,000
Railway rails.—			
From Great Britain ...	33,000	12,000	— 21,000
„ Belgium	76,000	80,000	+ 4,000
„ Germany	71,000	60,000	— 11,000
„ United States ...	3,000	2,000	— 1,000
Total ...	183,000	154,000	— 29,000
Telegraph and telephone material.—			
From Great Britain ...	6,000	6,000	—
„ Germany	2,000	4,000	+ 2,000
„ Sweden	3,000	8,000	+ 5,000
„ United States ...	2,000	—	— 2,000
„ Other countries ...	—	2,000	+ 2,000
Total ...	13,000	20,000	+ 7,000
Tramway rails.—			
From Great Britain ...	10,000	5,000	— 5,000
„ Germany	7,000	6,000	— 1,000
„ United States ...	24,000	8,000	— 16,000
Total ...	41,000	19,000	— 22,000
Tramway rolling-stock.—			
From Great Britain ...	17,000	3,000	— 14,000
„ United States ...	2,000	1,000	— 1,000
Total ...	19,000	4,000	— 15,000
Other tramway materials.—			
From Great Britain ...	15,000	8,000	— 7,000
„ Germany	1,000	2,000	+ 1,000
„ United States ...	5,000	4,000	— 1,000
„ Belgium	3,000	1,000	— 2,000
Total ...	24,000	15,000	— 9,000

In addition to the above the following were imported as "Government Stores" :—

Brassware.—			
From United Kingdom ...	5,000	5,000	—
Copper, plate and sheet.—			
From United Kingdom ...	8,000	15,000	+ 7,000
Electrical cable and wire.—			
From United Kingdom ...	44,000	65,000	+ 21,000
„ Germany	—	1,000	+ 1,000
Total ...	44,000	66,000	+ 22,000
Electric fittings.—			
From United Kingdom ...	25,000	15,000	— 10,000
India-rubber.—			
From United Kingdom ...	7,000	9,000	+ 2,000

	1910.	1911.	Increase or decrease.
	£	£	£
Lampware.—			
From United Kingdom ...	2,000	2,000	—
Cranes and elevators.—			
From United Kingdom ...	8,000	28,000	+ 20,000
Electrical machinery.—			
From United Kingdom ...	23,000	14,000	— 9,000
Other machinery.—			
From United Kingdom ...	67,000	52,000	— 15,000
„ Other countries ...	5,000	3,000	— 2,000
Total ...	72,000	55,000	— 17,000
Railway rails.—			
From United Kingdom ...	204,000	39,000	— 165,000
„ Germany	1,000	25,000	+ 24,000
„ Russia	40,000	—	— 40,000
„ Belgium	—	6,000	+ 6,000
Total ...	245,000	70,000	— 175,000
Telegraph and telephone material.—			
From United Kingdom ...	143,000	63,000	— 80,000
„ Sweden	2,000	17,000	+ 15,000
Total ...	145,000	80,000	— 65,000

THE SUNBEAM LAMP CO., LTD.

A MEETING of the creditors of this company was held at the offices of Messrs. Watson, Burton & Corder, Newcastle-on-Tyne, on June 3rd.

Mr. Thomas Wallace (the liquidator) said the meeting had been called for that date because it was the latest date permissible under the Act, and it had not been possible to formulate a scheme of reconstruction up to the present; but they hoped in the course of the next week or two that something tangible would be evolved. At the shareholders' meeting at which it was decided to go into liquidation, a Committee of Inspection was appointed of Mr. F. S. Newall and Mr. R. P. Sloan. Later the debenture-holders appointed Mr. Swan as receiver for the debenture-holders. The company was formed in 1887, and for the past 25 years had been in the forefront of manufacturers. Latterly, the carbon-filament lamp, which had been a great success so long, was displaced by the introduction of the metal-filament lamp, and they entered into negotiations so that they could manufacture the latter themselves. In order to do this the capital was increased from £25,000 to £75,000, and the debentures were increased by £25,000. When the manufacture was commenced it was hoped they would have substantial profits, but in a short time competition became so keen that a rapid reduction of price took place. There were also some troubles as to patent rights, in which the Westinghouse Filament Co. were concerned. Then came the tungsten drawn wire lamp, which superseded the metal-filament for small lamps, which necessitated them unloading themselves of the older lamps, and stocks were reduced to a minimum. At that time, having regard to their position and to the fact that creditors were pressing for payment, voluntary liquidation was deemed necessary. They hoped for a scheme of reconstruction of the company to take over the assets. Dealing with the financial position of the company, he gave the following details as to assets and liabilities:—Assets—Land, £1,292; erections, £10,041; plant and machinery, £15,683; general works and tools, £1,700; office furniture, £675; stocks, £10,000; book debts, £7,047; a total of £47,000. These figures (he explained in answer to a creditor's question) were taken from the last report. The liabilities were:—Debentures, £21,650; unsecured creditors, £9,890; preferential claims, £250; a total of £31,000 roughly, leaving a surplus, on paper, of £15,000. There were 354 creditors, and of these 111 were for sums of over £10. The liquidator concluded by stating that although no scheme had been formulated, they had tried hard.

Mr. Scholey (for the Allied Electrical Trades' Association) drew attention to the fact that a circular letter had been issued to some creditors and not to others, and he wished to know why proxy forms were sent out to some and not to all. He would like to know with what view they were sent out.

Mr. R. P. Sloan said he took it he was free to act in that matter. He wrote to some and not to others. He wrote because he did not want that business to go into the Courts, because he thought a scheme might be formulated, which would be prejudiced if they were to go into Court.

Mr. Scholey: Have you a scheme?

Mr. Sloan said there was a scheme.

Mr. Scholey was further questioning Mr. Sloan when the latter refused to be cross-examined.

Mr. Scholey said surely they should have some information as to the present position of affairs. Could the Receiver not give them some figures? They were accustomed in those cases to ask for the present position.

The Liquidator said they could not give that, as they had no valuation.

Mr. Scholey drew attention to the fact that the assets were £47,000 and the liabilities £31,000, yet the company found it necessary to go into liquidation. He would like to know if they had formed any idea, or had had a valuation taken, of the stock and general works. He also asked who were the debenture-holders in addition to the bank; what were the circumstances under which the Receiver was appointed; if the liquidator was a relative of a director of the company; if interest was paid on the debentures, or what induced the bank to appoint a Receiver. He also asked what were the prospects in case of a realisation.

The Liquidator said the company was not able to carry on for want of cash.

Mr. Scholey: Could not the shareholders have subscribed new capital?

The Liquidator said all the capital had been called up on the issued shares, but all the shares had not been issued.

Mr. Scholey asked if he would tell them what the scheme was they had in contemplation.

The Liquidator said he could not at present.

Mr. Scholey said, failing details, he should press for investigation.

The Liquidator (reverting to Mr. Scholey's former questions) said he was a nephew of one of the directors, but he resented the question, which he did not think should have been put.

A question was raised as to the collateral security held by the bank, and it was stated that there was a personal guarantee by some of the directors for £10,000.

The Receiver (Mr. Swan) said the bank appointed a Receiver because of the resolution to voluntarily wind up the company. As to the suggested scheme, if that estate was to be dealt with in the most advantageous manner, forced realisation must be avoided. They must appreciate that there was a difference between negotiations and an absolute scheme. They had got no cut-and-dried scheme, but they had laid the groundwork. Mr. Sloan had been working very hard to assist in bringing out a scheme. It was to the interest of that creditors' meeting to support any scheme in any shape or form. They knew the usual result of liquidation. They knew that after the debenture-holders, claiming £22,000, and special claims, £250, had been met, with the expenses of winding up there would not be much out of the £47,000. More money, too, would be required. They would do the best they could, but certainly any application to the Courts, or anything hostile, would not assist the scheme, and he did not see how the creditors would gain by it.

The representative of another creditor said he did not think he had ever attended a meeting where there had been put before it such a policy of "Open your mouth and shut your eyes and see what we will send you," as in that case. For his part, he must have some definite suggestion.

Mr. Sloan said he was far too busy a man to give his time if he did not think it were of use. He had done little else lately but work for that scheme, and he was not doing it for fun; he was doing it because he thought a scheme might be formulated and carried through. But personally, if it went into the Courts he washed his hands of it. He thought he understood the position as well as anybody else. Any application in Court would prejudice the matter.

Mr. Scholey asked if there were any scheme for a dividend for the creditors.

The Receiver said there was no definite scheme, but one was under consideration, and their position would be definitely known in the course of a week or so.

Mr. Scholey: Does it provide any cash for the creditors?

The Receiver: No. It might give them an interest.

Mr. Scholey: In shares?

The Receiver: It might be. He added that there was no advantage in a forced realisation.

Mr. Scholey suggested the appointment of a liquidator to represent the creditors.

The representative of another creditor asked whether the Liquidator was prepared to have a joint liquidator and a committee.

The Liquidator: I cannot answer that.

It was then suggested that the meeting might be adjourned, and, after some debate, it was decided to adjourn until Friday, June 21st.

A list of creditors appears under "Business Notices."

Curative Properties of Radium.—The Vienna correspondent of the *Standard* states that some interesting information about the therapeutic use of radium is contained in the first annual report of the Austrian State Kurhaus at Joachimsthal, published by the Austrian Ministry of Public Works. Over 10,000 baths of water from the radium mines have now been given, and good effects have been noticed, not only in cases of rheumatism and gout, but also in spinal paralysis of children, hæmorrhage of the brain and certain cases of neurasthenia. Further, it has been observed that corpulent patients are reduced in weight by a course of radium baths, and that teeth loosened by chronic inflammation can be made firm again by rinsing the mouth with highly radio-active water. Experiments made with the treatment of cancer are, so far, inconclusive, owing to the shortness of time.

Congress of Medical Electrology and Radiology.—In accordance with the decision of the Congress of Barcelona, the sixth Congress will be held at Prague on July 26th-31st, 1912. Particulars can be had from Dr. Krist. Hynek, Hôpital Général, Prague II, Austria.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

NEW ZEALAND.—The Customs Authorities have issued the following decisions as to the duties to be levied on certain goods; in all cases the duties quoted are those under the British Preferential Tariff:—

Distributors, being parts of magnetos for motor-car oil engines:

(1) If attached to engines	free
(2) If detached from engines	10 % ad val.

JAMAICA.—The Board of Trade have received a copy of a telegram from the Governor stating that the rate of import duty leviable on goods dutiable at the general rate of 16⅔ per cent. *ad valorem* will be reduced to 10 per cent. *ad valorem* from July 1st next. No change will be made in the rates of duty on goods dutiable at specific rates.

GREECE.—In connection with the law in force in Greece providing that the maximum octroi duty to be levied by municipalities on imported goods should be 4 per cent. *ad val.*, the Board of Trade have received information to the effect that the present rates of octroi duty vary for different articles and in different localities, but are generally as follows:—At Athens, 2¾ per cent.; at Piræus, 1½ per cent.; at Corfu, 3 per cent. at Patras, 2½ per cent.; at Vola, 3 per cent.; at Larissa, 3 per cent.; at Syra, 2 per cent. (flour 4 per cent.); at Kalamatta, 3 per cent.

The percentage rates of duty are assessed on the valuations contained in a special Valuation Tariff which may be inspected by British traders interested at the Board of Trade, 73, Basinghall Street, E.C.; and the Branch will also be prepared to furnish British traders, in response to written applications, with information as to the valuations for octroi duty purposes of any particular article or articles in which they may be interested. In the case of imported goods, the octroi duty is levied in addition to the Customs duty.

SANTO DOMINGO.—A decree has recently been passed fixing the amount of the fees to be charged by Santo Domingo Consular Officers abroad:—

For the certification of four copies of each invoice and corresponding bill of lading; the value of the goods included in the invoice being:

	Pesos.
From 1 to 50 pesos	1·00
„ 51 to 200 pesos	2·00
„ 201 to 1,000 pesos	3·00
„ 1,001 to 2,000 pesos	4·00
„ 2,001 to 4,000 pesos	5·00
And for each 1,000 pesos in excess of 4,000 ...	1·00

NOTE.—When the Consul is asked to sign more than four copies of the invoice or bill of lading, the fee charged will be 50 per cent. more than that chargeable for the four copies.

[£1 = 4·87 pesos.]

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

11,900. "Generation and utilisation of electrical energy." C. S. NORTHCOTE. May 20th.

11,957. "Devices for damping the oscillations set up in machines driven by prime movers." SIEMENS SCHUCKERTWERKE G.m.b.H. (Convention date, May 20th, 1911, Germany.) May 20th. (Complete.)

11,964. "Telephone systems." E. A. MELLINGER. May 20th.

12,001. "Means and apparatus for retaining incandescent electric lamps in their holders." C. H. KRUGER and H. E. HODGSON. May 21st.

12,014. "Electric auto-masseur." F. R. MILLER. May 21st.

12,028. "Installations for supplying electric current for lighting, heating and other purposes, on motor-cars, trains and the like." C. A. VANDERVELL and A. H. MIDGLEY. May 21st. (Complete.)

12,047. "Ignition systems." C. F. KETTERING. (Convention date, May 22nd, 1911, United States.) May 21st. (Complete.)

12,059. "Electric circuit-breakers." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) May 21st.

12,060. "Electric relays." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) May 21st.

12,075. "Electric heating device." H. S. MARTIN. May 21st.

12,079. "Electric light fitting. A. COLOMB. May 21st.

12,098. "Electric current graduating devices or resistances." W. SUMNER. May 22nd.

12,109. "Incandescent lamps and burners." G. HELPS. May 22nd.

12,116. "Telephone receivers." LONDROME SYNDICATE, LTD. (L. Gallotti, France.) May 22nd.

12,133. "Electric advertising appliances." J. MEYER and NEUHEITEN VERWERTHUNGS G.m.b.H. May 22nd. (Complete.)

12,134. "Speed regulation of asynchronous motors." BERGMANN ELEKTRICITATS-WERKE AKT.-GES. (Convention date, May 22nd, 1911, Germany.) May 22nd. (Complete.)

12,174. "Telephony." S. G. BROWN. May 22nd.

12,193. "Magneto-electric ignition apparatus." W. A. HILL. May 23rd. (Complete.)

12,212. "X-ray fluorescent screens." SIR D. L. SALOMONS. May 23rd. (Complete.)

12,223. "Dynamos." G. H. JACKSON and H. E. MOORE. May 23rd.

12,228. "Device for locking together an incandescent electric lamp of the bayonet-capped type and lampholder." G. E. MEEK. May 23rd. (Complete).

12,252. "Telegraphic apparatus." S. G. BROWN. May 23rd.

12,270. "Mercury-vapour lamps." P. G. TRIQUET. (Convention date, August 30th, 1911, France.) May 23rd. (Complete.)

12,273. "Electric fuse." W. B. BOYD and J. B. TANNAHILL. May 23rd.

12,305. "Manufacture of cable studs and analogous articles." L. BAXTER and E. VAUGHAN (trading as Baxter, Vaughan & Co.). May 24th. (Complete.)

12,313. "Clutch gear for Hughes telegraph apparatus." SIEMENS BROS. AND Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) May 24th. (Complete.)

12,320. "Current interrupter for high-tension lines." C. CLAR and T. CLAR. May 24th. (Complete.)

12,330. "Electrical heating apparatus." R. B. MATTHEWS. May 24th.

12,347. "Hygienic shields or protectors for transmitters or receivers of telephones, speaking tubes and instruments of a similar nature." M. H. FERGUSON. May 24th.

12,367. "Vacuum electric water heater." J. MANN. May 24th. (Complete.)

12,374. "Telephone installation for mines and the like." STERLING TELEPHONE AND ELECTRIC Co., LTD., and F. G. BELL. May 24th.

12,376. "Ironclad change-over switches and fused switches." H. H. BERRY and W. J. MARKHAM. May 24th.

12,379. "Timing devices for the electric ignition of internal combustion engines." ROBERT BOSCH (Firm of). (Convention date, July 14th, 1911, Germany.) May 24th. (Complete.)

12,380. "Electric search lights." SOCIETA ANONYMA OFFICINE GALILEO. (Convention date, May 31st, 1911, Italy.) May 24th. (Complete.)

12,381. "Holders for incandescent electric lamps." J. P. NAYLOR. May 24th.

12,425. "Electric printing." C. A. MUSGRAVE. May 25th.

12,444. "Arrangement of receiving stations for wireless telegraphy." CAPT. Z. DAN and G. ROTHLANDER. May 25th. (Complete.)

12,445. "Couplings and means for fastening wires together and to the terminals of electric batteries, lamps, walls and other apparatus or appliances." V. C. H. GIBSON. May 25th.

12,449. "Apparatus for operating electric search lights from a distance." SOC. ANON. OFFICIEN GALILEO. (Convention date, May 31st, 1911, Italy.) May 25th. (Complete.)

12,469. "Drawing of wires, and more particularly of tungsten and other metal filaments." C. GLADITZ. May 25th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

HYDRAULICALLY-BALANCED ELECTRIC LIFTS. E. M. T. Boddam. 8,356. April 4th.

HIGH-TENSION ELECTRICAL COILS, SUCH AS INDUCTION COILS, TRANSFORMER COILS, ARMATURE AND OTHER WINDINGS, AND THE PROCESS OF FORMING SAME. J. L. Milton. 10,827. May 4th.

MAGNETO IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES. J. L. Milton. 10,828. May 4th.

ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS. A. T. Dawson and G. T. Buckham. 11,019. May 6th.

MACHINE FOR MAKING ELECTRICALLY-WELDED CHAINS. M. B. Ryan. 11,794. May 16th.

ELECTRICAL SWITCH DEVICES, APPLICABLE TO THE WIRELESS CONTROL OF MINES, OR OTHER APPARATUS. C. Stille. 13,648. June 7th. (July 20th, 1910.)

TELEPHONE TRANSMITTERS. Siemens Bros. & Co. and C. R. Riber. 14,683. June 21st.

GLOW LAMPS FOR ADVERTISING PURPOSES. G. Rainaud. 14,731. June 21st. (June 22nd, 1910.)

ELECTRIC HEATING AND COOKING DEVICES. Ferranti, Ltd., and M. B. Field. 15,889. July 8th.

TELEPHONIC INSTRUMENTS, INCLUDING TRANSMITTERS. E. C. R. Marks. (G. R. Webb.) 16,956. July 24th.

ELECTRICAL INFLUENCE MACHINES (WITHOUT SECTORS). T. Clark. 17,452. August 1st.

ELECTRIC LAMPHOLDERS. H. Lucas and F. Jenkins. 19,182. August 26th.

ELECTRICAL CONNECTING APPARATUS OPERATED FROM A DISTANCE. G. A. Betulander. 19,553. September 2nd. (September 3rd, 1910.)

ELECTRIC MEASURING INSTRUMENTS. H. W. Brown. 20,452. September 15th. (October 8th, 1910.)

ELECTRIC COOKERS. R. Haddan. (Copeman Electric Stove Co.) 22,001. October 5th.

ELECTRICAL APPARATUS FOR SIGNALLING OR COMMUNICATING PERIODICALLY BETWEEN ONE PART OF A SHIP OR PLACE AND ANOTHER. R. H. H. Pring 22,039. October 6th.

TELEPHONE TRANSMITTERS. C. E. Egner and J. G. Holmstrom. 22,049. October 6th.

INCANDESCENT ELECTRIC LAMP AND HOLDER THEREFOR. C. Harvey. 23,979. October 30th.

ELECTRIC SWITCH. R. Heilbrun. 24,003. October 30th. (November 2nd, 1910.)

SOUND AMPLIFYING DEVICES FOR TELEPHONES, EAR- AND SPEAKING-TRUMPETS AND THE LIKE. H. C. Petersen. 24,098. October 31st. (November 11th, 1910.)

PROCESS FOR TREATING ANODE RESIDUES. H. Wehrlin. 25,179. November 11th. (January 11th, 1911.)

ELECTRICALLY-HEATED OVENS. G. Barker. (V. Weber & Co.) 25,962. November 21st.

ELECTRIC INSPECTION LAMPS FOR USE ON AUTOMOBILES. W. Peto and Peto and Radford, Ltd. 27,155. December 4th.

VAPOUR DEVICES FOR RECTIFYING ELECTRIC CURRENTS. F. Conrad. 27,686. December 9th. (December 10th, 1910.)

COLOUR SCREENS FOR LAMPS. Korting & Mathiesen Akt.-Ges. 27,850. December 12th. (May 29th, 1911.)

1912.

AUTOMATIC SAFETY SWITCH FOR ELECTRIC CURRENTS. F. Gruber and A. Frühwirth. 579. January 8th.

ELECTRIC FURNACES FOR ENDOTHERMIC GAS REACTIONS. H. Grohmann. 919. January 11th. (March 31st, 1911.)

ALKALINE ELECTRIC ACCUMULATORS. W. K. L. Dickson. 957. January 12th.

ELECTRIC SWITCH MECHANISM. J. W. Record. 1,817. January 23rd.

ELECTRIC HEATERS FOR LIQUIDS. J. P. Bland and E. G. Simester. 1,983. January 24th.

ELECTRICAL SWITCHES. A. Crawford. 2,896. February 5th.